

*To inspire ambition, to stimulate
the imagination, to provide the
inquiring mind with accurate
information told in an interest-
ing style, and thus lead into
broader fields of knowledge
such is the purpose of this work*

The New
PICTURED ENCYCLOPEDIA
Volume Seven

AMONG THE BRIGHT-HUED BIRDS OF PARADISE



KEY TO COLOUR PLATE

MOST brilliant and showy of all birds are the many species usually grouped together as "Birds of Paradise." They live in the East Indian island of New Guinea, on near by smaller islands, and at points on the adjoining north coast of Australia. Only the males have the fine plumage, which they show to gorgeous effect in "dancing parties," in the mating season. Whether the plumage serves merely to win the favour of their mates or thereafter serves a more lasting purpose in drawing off their natural enemies from the nest is not plainly clear.

bird and young, is a point undecided by naturalists; however, has nearly proved fatal to many species, for natives attend the "dancing parties" with arrows so blunt that the birds' valuable plumage is often destroyed.

The great bird of paradise (*Paradisea apollinaris*) is overleaf. His most striking feature is the great array of fine plumes springing from beneath the wings. He is being viewed with admiration by his plainly coloured lady (3). These birds are found particularly in the Aru Islands, adjoining New Guinea. With them in the picture we see a king bird of paradise (2) and a winged bird of paradise (4).

Curiously enough, the crow down that in the corner (5) is a close relative of the paradise family, far closer related than the lyre bird (6), despite the fact that the latter would seem more suited to this gorgeous company. The lyre bird dwells in Australia, and, like so many other animals of that continent, is a primitive type, despite his elaborate trappings. Unlike the birds of paradise he is a capable singer.

AMONG THE BRIGHT-HUED BIRDS OF PARADISE



Painting by Bruno Litz.

See text overleaf

In this picture the artist has included three different species of the paradise birds, a lyre-bird, and also, by way of contrast, a common black crow—for, curiously enough, the crow is a close relative of the paradise bird family. Read more about this colourful assemblage in the descriptive article overleaf where also you will find a key to this plate

THE NEW PICTURED ENCYCLOPEDIA

A Pictorial Treasury of Reading
& Reference for Young and Old

Edited by
SIR JOHN HAMMERTON

Editor, Universal Encyclopedia, Universal History of the World, Peoples of All Nations
Countries of the World Encyclopedia of Modern Knowledge New Popular Educator

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*Complete in Ten Volumes including Easy Reference Fact-Index
Study Outlines and Topics Guide to Every Day of the Year*

VOLUME SEVEN NAZ—PY

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HERE AND THERE IN THIS VOLUME

At odd times when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. With this as a guide, you may wander through storyland, visit far-away countries, meet famous people of ancient and modern times, review history's most memorable incidents, explore the marvels of Nature and science, play games—in short, find whatever suits your fancy at the moment. This list is not intended to serve as a table of contents, an index, or a study-guide. For these turn to the Fact-Index and Study Outlines in Volume Ten.

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CAN YOU ANSWER THESE QUESTIONS?

Since unnumbered thousands of questions are answered in each one of our ten volumes this page is intended merely as a sample of the pleasure and instruction that may be obtained by discovering interesting facts in this volume and passing them on to others in question form. There are many thousands more for you to draw upon as tests in General Knowledge

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WHEN YOU ARE IN NEED OF READY REFERENCE

In using THE NEW PICTURED ENCYCLOPEDIA as a work of reference, Volume Ten is indispensable. As regards its contents that particular volume is unique for it is at once a complete index to the preceding Nine Volumes and an Encyclopedia in itself. Its purpose is fourfold as indicated below.

(1) **Through the Year with the NPE** Its opening section takes the form of a Calendar of the Year, giving for each day all the chief events and matters of interest, with references to the pages of THE NEW PICTURED ENCYCLOPEDIA in which full particulars concerning the event, personality, or other interest of the day may be found. By the intelligent use of this section (a) the young reader can have the daily delight of reading about topics that have special association with the particular day of the year on which he may be making his reference, (b) father or mother can suggest what would be the most appropriate reading for the day, and (c) the school teacher can set the lessons for the day with a genuine topical appeal.

(2) **Study Outlines** This large and important section of the volume provides a simple method of study which should enable any of our young readers to become expert in using THE NEW PICTURED ENCYCLOPEDIA as an auxiliary manual of home study and thus what is learnt in school may be amplified and more securely fixed in the memory.

(3) **The Fact Index** Actually this is in itself a complete Encyclopedia. In addition to providing many thousands of references to contents of Volumes One to

Nine it records many more thousands of facts in biography, geography, history, science, the arts, etc, that are not mentioned in its nine predecessors. Therefore, if you look in vain for any subject in the alphabetical order of Volumes One to Nine, turn to Volume Ten and you will almost certainly find it there.

It is a good plan when using THE NEW PICTURED ENCYCLOPEDIA as a work of reference always first to look up any subject in the Fact-Index of Volume Ten.

(4) **Thousands of Additional Entries** Not only are all the many thousands of statements of fact that appear in the main body of the work carefully recorded in the Fact-Index for your immediate reference, but many thousands of additional entries are given in this exceedingly useful section of our work. By this method the reading pages of the work are saved from the burden of thousands of brief cross references, which the ordinary encyclopedic method would involve. These new entries in the Fact-Index, together with the treasury of reading embodied in Volumes One to Nine make THE NEW PICTURED ENCYCLOPEDIA the most comprehensive encyclopedic work produced in the present generation and assuredly the most readable encyclopedia of its kind.

KEY TO PRONUNCIATION

Most of the subject headings in THE NEW PICTURED ENCYCLOPEDIA require no special indication of the way in which they should be pronounced. There are also many for whose proper pronunciation it is only necessary to know which syllable is stressed, in these cases the stress is shown *after* the syllable, thus A'jax. Where further guidance is necessary, the following signs are employed

ah = a as in father

aw = a as in ball

ê = vowel sound in fern, word, girl,
ourl

ow = vowel sound in now, bout

oi = vowel sound in noise, boy

Unmarked vowels have their short sound, as a in hat e in bet, i in bit, o in not, u in but, oo in book.

Marked vowels have their long sound, as in hâte, bê, bîte, nôte, tûne, bôon

Vowels in italics have a slurred or obscure sound as in abet (a-bet'), recent (rê-sent), conform (kon-form'), nation (nâ'shun), tailor (tâ'-lor)

th = first sound in thing, thank

th = first sound in the, thirt

zh = s in measure, leisure

g = hard g, as in good, gul

j = soft g, as in gem, ginger

kh = guttural in loch

LIST OF ABBREVIATIONS

The abbreviations most commonly used in this work are noted below. A much longer list of abbreviations often met with in reading or conversation is given in the Fact-Index that is contained in Volume Ten

A D *Anno Domini* (in the year of our Lord, of the Christian era)

a m, *ante meridiem* (before noon)

b, born

B C, before Christ

C, Centigrade

c, circa (about)

Co, county, company

d, died

e g, *exempli gratia* (for example)

etc, *et cetera* (and so forth)

et seq, *et sequens* (and following)

F, Fahrenheit

h p, horse-power

i c, *id est* (that is)

lb, pound, pounds (weight)

m, miles

MS, MSS, manuscript, manuscripts

oz, ounce, ounces

p m, *post meridiem* (after noon)

Pop, population

Pron, pronunciation

q v, *quod vide* (which see)

sq m, square miles

St, Saint

U S A, United States of America

viz, *vide licet* (namely)

yd, yard

The BOYHOOD HOME of JESUS CHRIST

One of the holiest places in the Holy Land, Nazareth remains very much the quiet little place that it was when within its bounds Our Lord, as St Luke says, "increased in wisdom and stature, and in favour with God and Man"

Nazareth, PALESTINE In the Holy Land of Palestine, prettily situated among fig-trees, olive-trees, and cypresses on the southern slope of a hill midway between the Sea of Galilee and the Mediterranean, stands the little town of Nazareth—endeared to Christians throughout the world because it was here that Jesus Christ spent His years of boyhood and later, as a young man, worked in the carpenter's shop and taught in the synagogue

Little remains to remind us of the town wherein He passed those thirty silent years of preparation. At one time the synagogue possessed a book from which Jesus was said to have learned His alphabet, as well as the bench upon which He sat, and even at the present day visitors are shown Joseph's workshop and Christ's table, and quite a number of local sites are identified with incidents in His career. There is little doubt, however, that most of these identifications are quite without foundation, though the Virgin's Well was probably visited times without number by His Mother, Mary, as it is the only well in the neighbourhood. Then, too, not far away are some steep slopes, one of which may well have been "the brow of the hill whereon their city was built," over which His incensed fellow-townsmen threatened to "cast Him down headlong" when He told them that "Verily I say unto you, no prophet is accepted in his own country" (Luke 19).

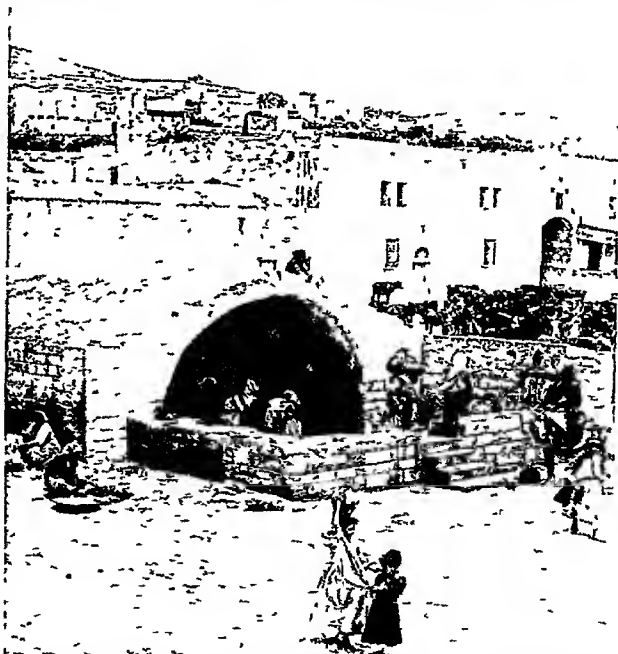
There is no mention of Nazareth in the Old Testament, it became important simply because of its connection with Jesus Christ, who is often called Jesus of Nazareth or Jesus the Nazarene.

For some hundreds of years after Jesus had left Nazareth for the last time, the little town continued its life of obscure uneventfulness. The first Christian pilgrims

to visit it came in the 6th century, and in course of time large and imposing churches were erected in the place.

In 1100 Nazareth was captured by the Crusaders, but 87 years later it fell to Saladin. After many further vicissitudes it was captured by the Turks in 1517 and remained in their hands for just over 400 years when, late in 1918, it was surprised and taken by British cavalry of Allenby's army.

Today Nazareth is once again a centre of Christian pilgrimage, and the little town continues to draw to its whitewashed houses and churches set in the sunny hills of Palestine



NAZARETH'S WELL THAT JESUS MAY HAVE KNOWN

The Fountain of the Virgin, or the Well of St Mary as it is often called, is probably the only relic left of the old Nazareth of the time of Jesus Christ. To this well—still the only supply of water for the whole town—or at least to this spot the Boy Jesus may often have accompanied His Mother when she went to draw water for the family.

numbers of those who love to tread where Jesus Christ Himself trod nineteen centuries ago. Its present population is just below 9,000, and its principal industries are lace-making and the manufacture of souvenirs for tourists.

Nebraska, U.S.A. One of the most important of the agricultural States, Nebraska is situated to the west of the river Missouri and to the east of the Rocky Mountains. Across the State flows the Platte, a tributary of the Missouri. Nebraska is a huge plain (area 77,520 sq miles), on which thousands of cattle are grazed, and thousands of acres of maize, sugar-beet, and other cereals are grown. It is sometimes known as the "tree-planters' State" from the vast forests planted by the earlier settlers. The largest city is Omaha (population, 214,000), the capital is Lincoln (population, 75,000). The total population of the State is 1,377,000.

Nebulae. A few of the stars, when carefully observed, seem to have a faint hazy appearance or to be surrounded by a kind of

bright mist. The telescope shows us that some of these are star clusters, consisting of as many as 50,000 separate stars, while others are true nebulae. Instead of being separate stars, the nebulae are vast aggregations of gaseous or smog-like matter which assumes various cloud-like forms. The name *nebula* is the Latin word for "mist" or "small cloud."

Nebulae are frequently divided into two classes—the green and the white. The large irregular nebulae are usually green, and are found in or near the Milky Way. It is supposed that they are mainly gaseous. Spiral nebulae, on the other hand, are white and may contain solid as well as gaseous matter. They are by far the most numerous of the nebulae, and are quite widely distributed. As with the case of the stars, the composition of the nebulae is discovered by means of the spectroscope. They contain at least one unknown element.

Like clouds, the nebulae have an infinite variety of shapes, and through the telescope they often present a picture of unsurpassed splendour.

The "Horse's Head" in the Orion nebula is a "dark" nebula—i.e., it consists of a mass of opaque gas. Some nebulae are ring-shaped, some spiral, and some planetary (disk-like), while others are given such fanciful names as "crab," "dumb-bell," etc.

Only two nebulae are usually visible to the naked eye—the great irregular nebula in Orion's sword-hilt, and the spiral nebula in Andromeda's girdle. But thousands of others can be seen through the telescope. The ring nebula in Lyra, the spiral nebula in Ursa Major, the irregular nebula in Cygnus, and the nebulae among the Pleiades are interesting.

The size of some of the nebulae is exceedingly great. If they were as near as the sun they would fill the heavens with an enormous blaze of light. The diameter of the Orion nebula, the greatest in the sky, is probably twenty million times that of the sun. The velocity of nebulae is staggering. We know, for example, that the Andromeda nebula is approaching the solar system at the rate of 200 miles a second.

In modern times the nebulae have probably been the subject of more speculation than any other group of heavenly objects. Practically all theories of the origin of the solar system assume that it evolved in some way out of nebulous matter. The most recent theories regard the spiral nebulae, in particular, as representing a

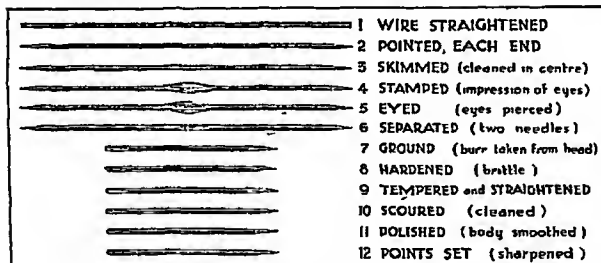


NEBULAE LIGHT AND DARK

This photograph, taken at the Mount Wilson Observatory, shows part of the great "light" nebula just south of the star Zeta in Orion's Belt. The black patch in it is the famous Horse's Head, one of the "dark" nebulae, probably composed of a huge mass of opaque gas. The bright rim round the fantastically-shaped head probably indicates that its other side is luminous.

possible early stage of the evolution which ultimately produced the sun and the planets. How the spiral nebulae themselves were formed can be no more than a guess. They may have resulted from the close approach of two suns, or perhaps from the collision of great groups of suns.

According to the French astronomer Laplace (1749-1827), all the matter constituting the solar system was once a great mass of glowing hot vapour or gas, resembling one of the gigantic nebulae we can now see through the telescope. This mass was supposed to be rotating at an enormous speed. As it cooled and contracted, the central mass began to rotate still more rapidly, till a series of rings (like those around Saturn) was thrown off and left behind. These rings, according to the theory, then condensed into planets, one of which is the earth. As the process went on, the planets themselves threw off rings which in turn condensed into moons or satellites. Saturn's rings are referred to as an example where the process is not complete. The rotation of the original mass produced the revolution of planets and satellites in their orbits. This nebular theory has been generally replaced by the "planetesimal theory" (See Planets)



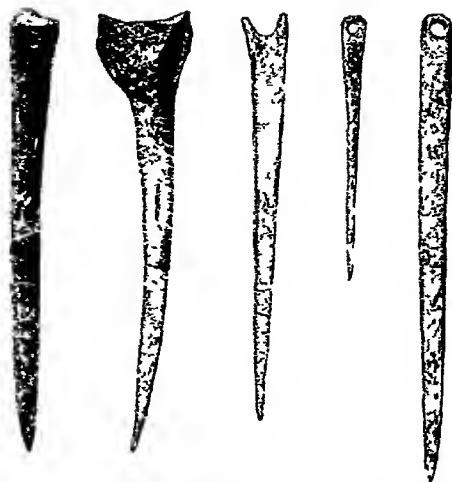
NEEDLES OLD AND NEW

In the far distant ages of the cave-dwellers, housewives did their primitive mending with needles carved from reindeer horn and bodkins of ivory and bone, like those seen in the top photograph. Modern machinery now produces millions of needles of faultless quality for a variety of uses. The illustration above shows some of the various stages through which an ordinary needle passes during manufacture.

Lower photo by courtesy of the Storratt Ltd

Needles. Needles of fish-bone, stone, iron, and bronze have been found that were used by early peoples more than 10,000 years ago. Some of these old needles have the eye for carrying the thread at the point, as in the modern shoemaker's awl, some have it halfway between the head and the point, and some have no eye at all, having been used like an awl to punch holes, through which the plant fibres or thongs of leather could be drawn.

Not less than twenty different processes go to the making of a steel needle today. Steel wire, drawn specially for the purpose, is cut into pieces the length of two needles. As the wire



has been wound on spools, these little pieces of wire are slightly curved. To make them straight they are gathered into bundles and heated until they glow dull red, as they cool they are rolled to and fro over an iron plate and pressed with a curved bar.

Next the wires are carried along to a grindstone and held against its face with a rubber band till a sharp point is put on each end. A rapidly revolving pulley draws these wires from the wheel and feeds them into a machine which marks the place for the eyes. The eyes are punched by other machines, and the double needles are strung on two slender wires, thus, when divided between the

eyes, each row is still strung on a wire. The heads are next filed into shape in a vice like arrangement, and the needles are ground, polished, and tempered until they are perfect. Sorted according to size, they are put up in papers or boxes.

Negro. The negro race in the broad sense includes the woolly-haired, thick-lipped, broad-nosed, black or dark-brown inhabitants or former inhabitants of Africa. From central Africa, where the pure negro is found, the type shades off by gradual and imperceptible steps into the Semitic (Arab) and Hamitic (Egyptian and Libyan) types in the north, and into the

Bushmen and Hottentots in the south (*See Africa*) Outside of Africa, types resembling the negro, called "negroids" and "negritos," exist on some of the larger islands and coasts of the western Pacific Ocean, notably in certain parts of the Philippines, on the Malay Peninsula, in New Guinea, and in Australasia.

Through importation as slaves, the true negro types are found in almost all parts of the two American continents, largely mixed with white and native Indian blood. The mixture of negroes and Indians occurs chiefly in Central and South America. In Brazil, where the slave trade with Africa continued until 1854, the negro elements form today a large proportion of the population (*See Brazil*). In Cuba, Haiti, Jamaica, and other islands of the West Indies the black race predominates.

In the United States an exceptional situation exists, for the races have not blended together to

the same extent as elsewhere. A sharp line of distinction is drawn between whites and blacks, and all who have negro blood, even in a small proportion, are classed generally as the negroes.

Until after the American Civil War little effort was made to educate the negro. In fact, the slave was often forbidden by law to learn to read and write. As soon as he gained his freedom, Church societies in the northern states began the great task, and large numbers of men and women teachers went south and started schools. Today, through the efforts of educated negroes, much is being done to supply cultural facilities, and each year sees more teachers, physicians, lawyers and business men among the negroes.

It is estimated that the African negro population is about 125,000,000. The great racial groups and their widely differing habits and customs, languages and religious beliefs, are described under the heading Africa.

The IMMORTAL VICTOR of TRAFALGAR

History's most brilliant sea-captain, a man of immense courage, the real saviour of England from Napoleon—no wonder Nelson was the adored of all in his life-time, and has been a national hero ever since

Nelson, HORATIO (1758-1805) The most famous naval commander of the greatest maritime power in history was so frail that he was not



National Portrait Gallery

expected to live to maturity. But his father's small income as rector of the little parish of Burnham Thorpe in Norfolk forced the boy to leave his quiet home at twelve years of age and enter the Navy as a midshipman. His uncle, on whose vessel he made his first voyage, thought that the idea of trying to make a sailor out of the delicate, undersized boy was a piece of folly, and that the most meritorious course would be to discourage him. So the first day at sea he ordered the boy aloft, saying, "Are you afraid, lad?" "Yes, sir," replied the shivering morsel of a man, "I'm afraid, but I'm going to the top of the mast, sir." And go he did.

But he never forgot that sickening experience, and when at the early age of twenty-one he was captain of a frigate, he used to race the new boys up the mast and salute them at the top. He abolished some of the severe punishments then practised, saying that cruelty made cowards. He promoted brave men and treated members of the crew with great consideration.

Nelson's rise to fame began in 1793, during the war with revolutionary France, when he was put in command of the 64-gun ship *Agamemnon*. Repeatedly during the next three years he distinguished himself by bravery, coolness, and judgement. During one of the famous engagements of this period—the battle of Calvi—he lost his right eye, and not long after, in an assault on Santa Cruz, in the Canary Islands, he received a wound which cost him his right arm.

His heroism was rewarded by a pension, knighthood of the Order of the Bath, and promotion to the rank of rear-admiral. Now came Nelson's great chance. He was assigned to hunt out and destroy the fleet with which Napoleon hoped to invade Egypt and strike British commerce at its most vulnerable point—the overland route to India.

Victory of the Nile

On August 1, 1798, he attacked the French ships in Aboukir Bay, at one of the mouths of the Nile. "Where there is room for a French ship to swing at anchor," he said, "there is room for an English ship to sail", so he boldly sent half his fleet into the narrow space between the French ships and the shore, while the rest attacked from seaward, thus raking the enemy from both sides. This smashing victory of the battle of the Nile, as it was called, made the one-eyed and one-armed admiral the idol of England. He was raised to the peerage as Baron Nelson of the Nile, and honours were heaped upon him.

Three years later (1801), when he had become vice-admiral, Nelson was sent to coerce the

Baltic states, winning a notable victory over the Danish fleet at Copenhagen. In the midst of the battle Nelson's superior hoisted the signal of recall. Putting the telescope to his blind eye, Nelson said "I really do not see the signal," and turned what might have been disaster into triumph. As a reward for this exploit he was created a viscount.

After a few months of leisure, Nelson was called from retirement to defend England once more from the menace of Napoleonic invasion, and put in sole command of the Mediterranean fleet. For many weary months he lay off the port of Toulon. When the French fleet slipped out, he chased it to the West Indies and back, laid siege to it and the allied Spanish fleet in the harbour of Cadiz, and brought them both to bay off Cape Trafalgar (October 21, 1805). When going into battle, Nelson flew from the mast-head of his flagship, the Victory, the signal that ever since has been Britain's watch word "England expects that every man will do his duty."

Nelson went into battle wearing his decorations, and when Captain Hardy remonstrated, pointing out that they would make him an obvious mark, Nelson replied, "In honour I won them, and in honour I wear them."

In arranging the order of battle, Nelson appointed his own ship, the Victory, to a place of great importance and danger. In the course of the strife the Victory became entangled with the large French ship, the Redoutable, and a fierce fight ensued. A broadside from the Victory drove the French gunners from their posts, but they kept up the fight with muskets. Then the Frenchmen attempted to board the English ship to capture her in a hand-to-hand fight, but a storm of grapeshot put an end to their attempt.

At this moment Nelson, walking the quarter deck with Hardy, was wounded by a musket-shot from the Redoutable—his medals, as Hardy had feared, had made him conspicuous to the enemy. He fell to the deck, and when Hardy attempted to raise him he said, "They've done for me at last, Hardy." "I hope not," Hardy replied. "Yes," said Nelson, "my backbone is shot through."

While Nelson lay dying in his cabin, his men had gained a decisive victory over the French, and before he died Hardy brought him word that fourteen or fifteen of the enemy's ships had surrendered. "That is well," Nelson said, "but I bargained for twenty." And with

the words "Thank God, I have done my duty," he passed away at about half-past four on October 21, 1805, in the very hour of victory.

His flagship (see page 2889) brought the news home, and England learned with pride of her greatest naval victory since the defeat of the Armada, and with sorrow of the death of her great commander, England's "greatest seaman."



NELSON 'SEEN OFF' FOR THE LAST TIME

When, after the short period of the Peace of Amiens, war between England and France broke out again in 1803, Nelson was at once selected for the Mediterranean command. He hoisted his flag on board the Victory at Portsmouth on May 18, 1803, and two days later set sail from England for the last time. Above is a reproduction of a painting by Gow, in the Royal Exchange, London, showing Nelson leaving Portsmouth for his last voyage.

since our world began," as Tennyson aptly called him. He was buried in the crypt of St Paul's Cathedral on January 9, 1806, and is commemorated by the Nelson Column and its site, Trafalgar Square, in the heart of London.

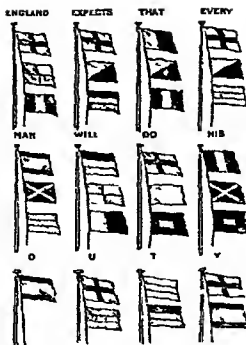
As a young officer on the West India station Nelson, in 1787, had married Mrs Nisbet, a doctor's widow with a little boy, but the marriage was unhappy. In 1798 began his passionate friendship for Emma, Lady Hamilton.

On his death Lady Nelson was given a pension of £2,000 a year, and his brother, Rev William Nelson, was created Earl Nelson of Trafalgar with a pension of £5,000 a year.

The present Earl Nelson is descended from a son of the great admiral's sister.

Lady Hamilton died (in reduced and rather sad circumstances) at Calais in 1815. She was one of the most beautiful women of her time, a fact to which more than twenty portraits by Romney bear witness.

Nemesis. (Pron nem'-ë-sis) The personification of divine justice, Nemesis was represented in earlier Greek mythology as a goddess, the daughter of Night. The name meant originally the one who measures out, hence she was regarded as the one who distributes good or bad fortune to each man according to his deserts, and punishes any viola-



NELSON'S SIGNAL

No fewer than 31 flags were needed by the signalling code in use in 1805 to send Nelson's famous message to the fleet before Trafalgar.

(in London) The sovereign of Nepal delegates all power to his Prime Minister, who holds a hereditary rank by special rules of succession.



NELSON MORTALLY WOUNDED IN THE HOUR OF VICTORY

This illustration from the picture by Sir Benjamin West, R.A., shows the scene on the quarter-deck of the Victory when Nelson fell mortally wounded by a shot fired by a marksman from the muzzon top of the French ship Redoubtable. The bullet penetrated the spine, and Nelson was carried below to the cockpit where he lived for three hours, dying at half-past four on the afternoon of October 21. In the picture, Hardy, the Commander of the Victory, is seen holding Nelson's hand, and he was present when Nelson died.

tion of justice or any arrogance or presumption on the part of men. Later she was thought of only as the angry avenger of crime, pursuing the evil-doer relentlessly like the Furies or Erinyes (See Furies). She was sometimes represented as carrying a measuring-rod, a hride, a sword, and a whip—emblems of her functions.

Nepal. (Pron ne-pawl') Among the mighty Himalaya Mountains, between India and mysterious Tibet, lies the independent Kingdom of Nepal. It is not part of the Indian Empire, the British Government being represented since 1934 by His Majesty's Envoy Extraordinary and Minister Plenipotentiary, while there is a Nepalese Ambassador to the Court of St James's.

The sovereign of Nepal delegates all power to his Prime Minister, who holds a hereditary rank by special rules of succession. Nepal is by no means small, the area is about 54,000 square miles. The population (5,600,000) consists largely of the famous Gurkha tribes, from whom are recruited some of the pick of the Indian Army. All are now friendly to Britain, and many Europeans now travel the road that leads to Khatmandu (pop., 80,000), the capital.

The traveller must first cross a long narrow region of downland called the Terai, north of this is forest abounding in wild game. Along the northern boundary are some of the greatest peaks on earth, Everest (29,000 ft.), Kinchunga (28,146 ft.), and Dhaulagiri (26,705 ft.) among them.

The soil is extremely fertile, and a thriving export trade is carried on in hides and cereals.

Neptune. In Roman mythology the name Neptune is given to the Greek sea-god Poseidon. He is usually shown as a bearded man standing in a shell drawn over the sea, and holding a three-pronged spear or trident. (See Poseidon)

In astronomy the name Neptune is given to the outermost planet but one of the solar system. It is thirty times as far from the sun as the earth, and is invisible except through the largest telescope. Its discovery in 1846 came as the result of certain investigations in the movements of Uranus, which led two astronomers, J. C. Adams (Cambridge) and U. J. J. Leverrier (France) to predict the presence of an unknown planet at almost the exact place where the telescope revealed Neptune. This large planet is over four times the diameter of the earth, and takes 164 years to go round the sun. (See Astronomy, Planets)

Nero, EMPEROR OF ROME (A.D. 37-68) Lucius Domitius Ahenobarbus Nero, who has become the type of a monster of iniquity and cruelty, began his reign in the year A.D. 54 at the age of seventeen, a handsome, talented, and by no means bad-hearted youth. Although Nero owed his throne to a crime, the flame for this rested on his wicked mother Agrippina, whose ambition for her son knew no bounds. She married the Emperor Claudius, and influenced him to put aside his own son, Britannicus, in favour of Nero. Then, becoming impatient to see her own son placed upon the throne, she caused the Emperor Claudius to be poisoned.

The Romans looked with favour upon Nero, since he was descended on both sides from the great Augustus. Under the influence of his tutor, Seneca—a wise philosopher and brilliant writer (c. 4 B.C.—A.D. 65)—all went well for a year. Then Nero's evil traits began to develop. Worst of all, he was cowardly, and committed one crime to cover up another. He caused Britannicus to be poisoned in A.D. 55, and four years later had his own mother slain by swordsmen. He divorced and later put to death his wife Octavia. He killed his second wife Poppaea Sabina in a fit

of rage. A third woman who refused to marry him was slain, and he killed the husband of a fourth woman so that she might become his wife. He was insanely suspicious of all his associates. Upon discovering a plot against him, he had Seneca, his early tutor, put to death, together with many other famous men.

During his reign a great fire broke out in Rome which burned for a week and destroyed more than half the city. It was rumoured that Nero himself had started the fire, and that, as he watched the conflagration, he played upon his "fiddle" (lyre) and recited verses about the burning of Troy.

Historians are generally agreed that there was probably no foundation for this charge, but at that time many believed it. In order to free himself from suspicion, Nero fastened the blame upon the Christians, and caused numbers of them to be put to death with the most cruel tortures. This is reckoned as the first of the ten great persecutions of the Christians under the Roman Empire.

After the fire Nero set about rebuilding the city, and erected for himself a magnificent palace called the "Golden House." But his heavy taxation, misgovernment and cruelty caused discontent and then revolt in the provinces. The rebellious troops under Galba, the Roman governor of Spain, marched upon Rome, and were joined by the emperor's own bodyguard. Nero fled, and news came to him in his hiding-place that the Senate had



NERO VIEWS THE RUINS OF ROME

Though it was whispered at the time that the fires which destroyed half Rome in the year A.D. 64 were planned by the Emperor Nero himself, historians are now inclined to believe that there is no truth in the assertion. This imaginative painting by Carl Feydy depicts Nero viewing the ruins after the destruction of the city.

sentenced him to death and proclaimed Galba emperor. At the approach of the horsemen who came to drag him to execution, Nero commanded an attendant to stab him to death, exclaiming, "What an artist dies in me!"

Thus passed away the last of the Augustan line of Caesars. His enthusiasm for art, and any other good qualities he may have had, were soon forgotten, and his name is one of the blackest in history.

Nerves. "Ting-a-ling!" You go to the 'phone and hear your friend speaking at the other side of the town. There is a wire from his house to the exchange, and one from the exchange to your house. The operator connects the two, and then you can talk with each other.

The nerves form the "telephone system" of the human body. They put every individual part of it into direct communication with the "exchange" in the brain, and thus with one another. Anything which interferes with this communication leaves some part of the organ so cut off that its nutrition may be endangered, its wastes may accumulate, and it may become a prey to disease. In any case it is out of control, and its usefulness is destroyed or impaired until nerve communication is again established.

Unlike the city telephone system, each of the nerve wires or fibres carries messages only in one direction. Oftentimes there is a special "private line," which takes care of a particular kind of business and that only. For example, the optic nerve takes care of "sight" messages only, the auditory nerve of "sound," and so on.

Those nerves which carry incoming messages, *i. e.*, towards the brain, are called "afferent" nerves, and it is they that bring us all our information from the outside world. Those which carry outgoing messages are known as "efferent" nerves, and they are concerned with the various activities of the body. Some efferent nerves are "motor," that is, they cause

muscles to contract, others are "secretory," that is, they cause glands to secrete.

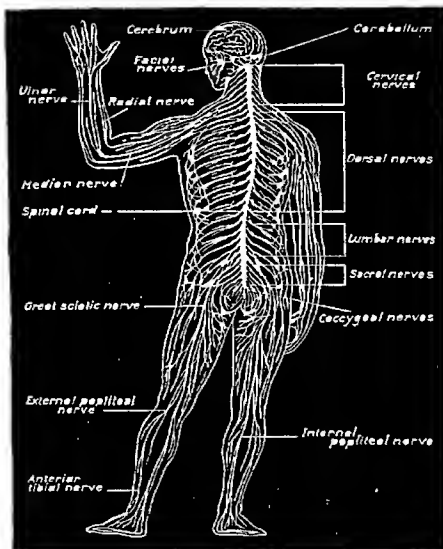
The nerves can be seen as the whitish cords that run between the muscles of the body, branches going into each muscle and to every part of the skin. Usually we find the nerve fibres for any part of the body bound together into one bundle or cable, and they do not separate until just before they reach the spinal cord. There they divide into two roots, and each root contains only one kind of fibres. One root enters the spinal cord towards the front. This root contains efferent fibres. The other root enters the spinal cord at the back and is composed of afferent fibres.

These afferent and efferent fibres connect with collections of nerve cells in the cord. Such collections we know are composed of "grey matter," and they both receive and originate messages. They are the "branch exchanges" of our telephone system, and are connected with the chief exchange in the brain. Those efferent nerves which deal wholly with our involuntary or unconscious life (such as heart action, secretion, stomach and intestinal movements, and the like) are called the "sympathetic" nerves, while those nerves which deal with our conscious movements directing our voluntary acts are known as the "cerebro-spinal" nerves. The "cerebro-spinal" nerves are attached to the spinal cord. The sympathetic system has its own con-

necting fibres running outside the vertebrae, and has three great centres—the cardiac, solar, and hypo gastric. These are called "plexuses."

In the human body there are twelve pairs of nerves connected with the brain, called the cranial nerves, and thirty-one pairs connected with the spinal cord, called the spinal nerves.

It is interesting to know that the nerves grow in the same direction that the message is to travel. For example, the optic nerve (which carries an ingoing message) begins to grow at



NERVES OF THE HUMAN BODY

From the spinal cord issue, in all, 31 pairs of spinal nerves, each pair coming from between two vertebrae through an opening called the intervertebral foramen. There are eight pairs of cervical, twelve pairs of dorsal, five pairs of lumbar and sacral, and one pair of coccygeal nerves.



D. Meier 1

SAILS OVER THE NETHERLANDS

Windmills, like this one near Flushing, are to be seen all over the Netherlands for the sails work the pumps that help to keep the sea from overflowing on to the land. There are not so many as there were, however, for electric pumps are being increasingly used.



V. Scholte

MAKING THE CLEAN STILL CLEANER

Dutch homes are familiar to most of us through the beautiful pictures of the old Dutch painters. Patterned tiles in bright colours, dishes of Delft ware on shelves all round the walls, polished brasses, straight-backed chairs, and flagged floors with rush mats—all these are almost invariably to be seen in a Dutch living-room.

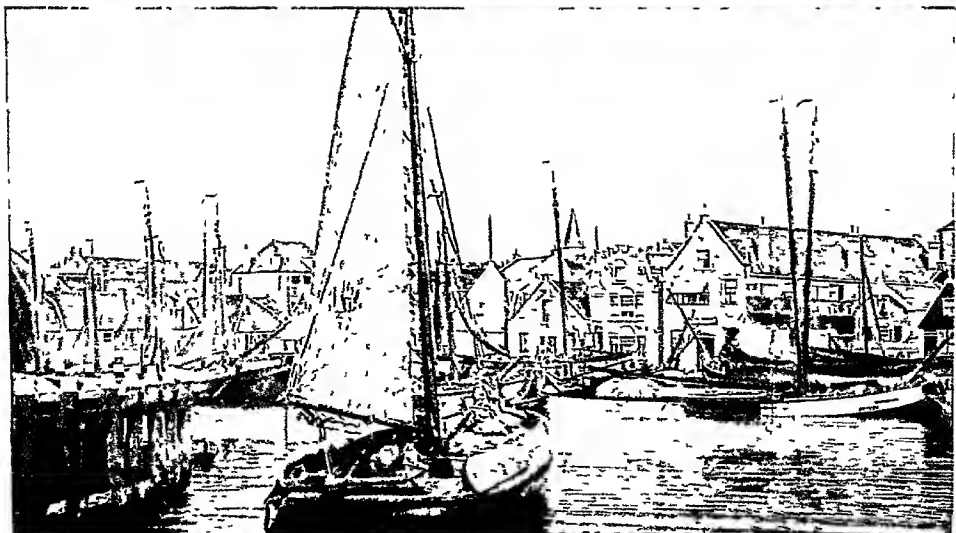


D. Melish

A QUIET CORNER OF THE LOW COUNTRIES

Perhaps of all the towns of Holland, Middelburg, the capital of the province of Zeeland is the best known to English visitors for it is only four miles from the port of Flushing. This photograph of two Zeeland women exchanging the day's gossip in a peaceful by-way gives an excellent impression of the little town's old-world air.

IN A FISHING VILLAGE OF THE NETHERLANDS



The traditional costume of the Dutch fisherfolk, seen in the upper photograph is one of the most delightful survivals in this picturesque land. The harbour of the tiny island of Urk (lower picture), now situated on the edge of the freshwater Yssel Lake still provides anchorage for sturdy fishing smacks, though not so many as in the prosperous days of the Zuider Zee.

Photos: Natcholls and D. McElish

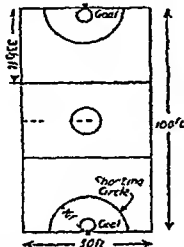
he retina and grows in towards the brain. While the motor nerves (which carry outgoing messages) begin at the nerve centres and grow towards the outside of the body.

Netball. Like the other girls' sports lacrosse and hockey, netball, which should not be confused with basketball (qv), is an exceedingly fast game. It requires speed ability to dodge with extreme quickness, and a keen eye.

The game may be played either indoors or outdoors on any level space on which a rectangular court, usually 100 feet by 50 feet, can be marked out. At each end of the court which is divided into three equal parts, a shooting circle is marked 16 feet round the goal post, which is placed in the centre of the goal line.

In the centre of the ground a circle 4 feet in radius is drawn. The ball is an ordinary Association football. The goals consist of an iron ring 15 inches in diameter, placed horizontally 10 feet above the ground, projecting 6 inches from the support, and bearing a net.

There are usually seven players in a team—centre, attacking centre, goal scorer, defending centre, attack, defence, and goal keeper. At the start of the game one of the two umpires goes to the middle of the court and bounces



NETBALLERS 'JUMP TO IT'

In this action photograph of a girls' netball match the player in the centre, defending the goal, has made a good save in the shooting circle from the player on the left. There are seven players on each side.

the ball in the centre of the field. Each team then tries to throw the ball into its opponents' goal, and every time it succeeds a goal is scored. It is permissible to bat the ball with the hands and to throw it, but it may not be carried, kicked, or punched.

LAND of BULBS and WINDMILLS

Though it is a small country, Holland is full of interest to the tourist, its canals, windmills, and bulb-fields provide beauty, and its reclaimed land gives evidence of Dutch industry and courage.

Netherlands. The kingdom of the Netherlands, popularly called Holland because of the historical, economic and political importance of the two provinces, North and South Holland, consists of the delta land of three great rivers, the Rhine, the Meuse (or Maas, as the Dutch themselves spell it) and the Schelde, with an area of 12,690 square miles, excluding water, and a population of about 8,556,000. Almost half of the land, including the three largest cities, Amsterdam, Rotterdam, and The Hague, lies below sea level. The shores of sea and rivers alike

are dyked, and thousands of windmills with ladder-like sails are kept busy pumping water night and day, without rest, back into the sea.

The dykes are carefully built and carefully guarded, for Holland had its warning more than 500 years ago when the North Sea swept

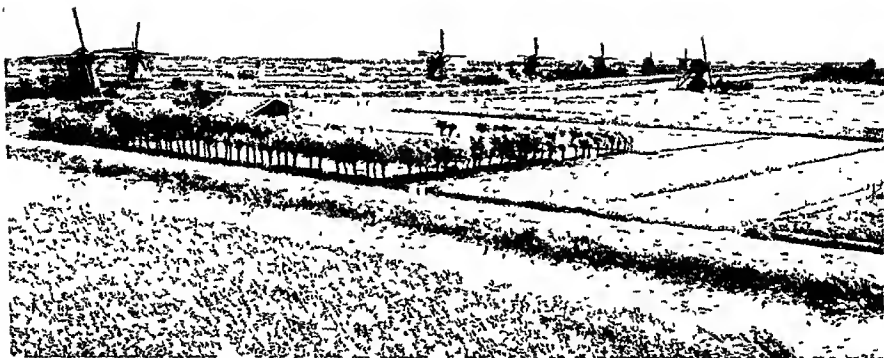
into the very heart of the country, covering hundreds of towns and villages and forming the Zuider Zee. In 1924 work was begun on draining a large area of the Zuider Zee, and when in 1933 the last gap of an 18 mile dyke was closed, it was finally cut off from the North Sea and

Extent—North to south 210 miles, east to west 120 miles. Area about 12,690 square miles exclusive of gulfs and bays. Population 8,556,000.

Natural Features—Level surface with almost all coastal portion below sea-level and protected by dykes and extensive drainage systems—mouths of Rhine, Maas (Meuse) and Schelde rivers, and numerous canals.

Products—Butter, cheese, and milk, flower bulbs, rice, oats, potatoes, sugar beets, and wheat, herring and oysters, coal cut diamonds, ships, textiles, flour, shoes, margarine, bricks, tiles, machinery, printed matter, cocoa, chocolate.

Cities—Amsterdam (788,000), Rotterdam (665,000), The Hague (capital, 490,000), Utrecht (162,000), Haarlem, Groningen, Eindhoven (more than 100,000).



WHERE WINDMILLS KEEP THE SEA AT BAY

Through many centuries the people of the Netherlands have waged a hard fight to keep the sea from inundating their low-lying country. Dykes and dams are not sufficient, and pumps are always at work to clear away the surplus water. A large number of them are still worked by windmills, and rows of these, such as that seen in the photograph, are so familiar a feature of the landscape that Holland has been called "the land of windmills."

Photo J. C. van Aulst

was thenceforth named the IJssel Lake. Reclamation of a further area, this time consisting of 200 square miles, was started in 1934, but the whole scheme is not likely to be completed until about 1960.

When you visit Holland you will think that it looks like no other country in the world, with its flat meadows, its canals and their barge population of 50,000 to 100,000, who live their whole lives in those queer craft with bright red cabins and miniature gardens, its storks, its windmills, and its red-roofed villages.

What the Dutch Folk Look Like

Holland's pleasant land has an attractive people. The Dutch are known to everyone for their quaint costumes varying with the district—the wooden shoes and baggy trousers of the farmers and fishermen, and the queer, neat caps worn by the women in many provinces. In the cities, however, they look like the best and most alert type of Englishman, well-dressed and well-educated, with clear, ruddy complexions, and often they speak English uncommonly well.

Almost everywhere in Holland the past is as much with you as the present. There are great Gothic or Renaissance cathedrals many times too large for the now shrunken towns, and almost always whitewashed to conform to

the requirements of the Protestant church. You also find many old town-halls and weigh houses where for hundreds of years the cheeses have been weighed. Everywhere are definite landmarks of the Spanish tyranny over the Netherlands, of Prince William the Silent, who led the revolt against it, and of Holland's brave struggle towards a republic.

In art as well as in architecture the past is represented, for the art galleries of even some of the smaller cities of Holland are the envy of some of the greatest capitals of Europe, not only for their collections of the Dutch school—Rembrandt, Gerard Dou, Franz Hals, Jan Vermeer, Ruysdael, Hobbema, and others—but of the schools of France and other lands as well. And you will be shown the houses of Holland's saints, philosophers, and scholars—Thomas a Kempis, Erasmus, Spinoza, and Hugo Grotius.

No matter how long you stay in Holland, and in spite of knowing that it is a small country, you will continue to be surprised that its great cities are so close together. From Rotterdam a ride of an hour and a half on a river steamboat will take you past fisheries, and ship-yards, to the much-painted city of Dordrecht, whose four rivers and the connecting canals will remind

TRADITIONAL DRESS IN THE LAND OF THE DUTCH



The first three pictures illustrate the varied dress worn by the Holland peasants. The two women with the shoulder "wings" (1) are from Axel, a city about 20 miles west of Antwerp. The man and his wife (2)—both in their "dresa-up" clothes—are fisher folk from Scheveningen, a fashionable watering place. The two girls in the centre (3), with their typical Dutch caps, are from the city of Volcedam. The bottom picture (4) shows the interior of a Dutch home on the island of Marken. The houses of the Dutch, no matter how poor the occupants, are always clean and attractive.

NETHERLANDS

you of Venice Dordrecht was once the richest town in Holland, and it is still one of the most beautiful, and a favourite with painters

A little steam barge will take you by canal from Rotterdam to Delft, once famous for its pottery, now for its quiet picturesqueness and for the fact that it contains the tombs of William the Silent and Grotius Not far north of Delft lies The Hague, the capital of Holland From there you will want to walk or ride down the old road to Scheveningen, once a simple fishing village with an attractive old-world flavour, now a fashionable watering-place, and to the quaint old university town of Leiden

Miles of Tulip Blooms

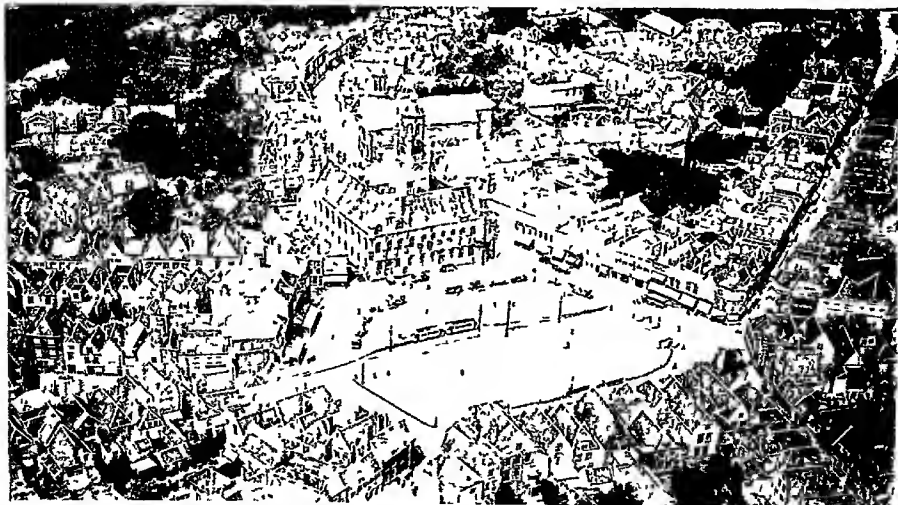
If you are at Leiden in April you will want to make the short rail journey to Haarlem, in the heart of the tulip country For mile after mile you ride through flat lands carpeted with squares of red, yellow, white, and purple tulips and hyacinths Great heaps of the bright flowers are piled up in the corners of the fields to be used in fertilizing, for the bulbs and not the flowers are sold

At Haarlem you are only ten miles by train west of Amsterdam, but for that matter it would have taken you only an hour and a half to make the direct railway journey straight through from Rotterdam From Amsterdam

there are many little journeys to be made—to the picturesque village of Maiken, where there was a flourishing fishing community until the draining of the Zuider Zee took the sea away, to Edam, the home of red cheeses, which was once the water-gate of Amsterdam, before that city had a North Sea canal, to Alkmaar, where every Thursday peasants in boats from neighbouring farms unload the yellow cargoes, flinging the cheeses to men on the quay, to be sold at the famous Friday cheese market

Only 42 minutes by train from Amsterdam and 35 minutes from Rotterdam lies Utrecht, "the city of spires" and also of bridges—95 of them at a conservative estimate It was here that the northern provinces organized their resistance to Spain in 1579, and that the peace treaty between France, England, and Austria was concluded in 1714 From Utrecht an hour's ride will take you to the least Dutch of Dutch cities, Arnhem, lying in a district of wooded hills

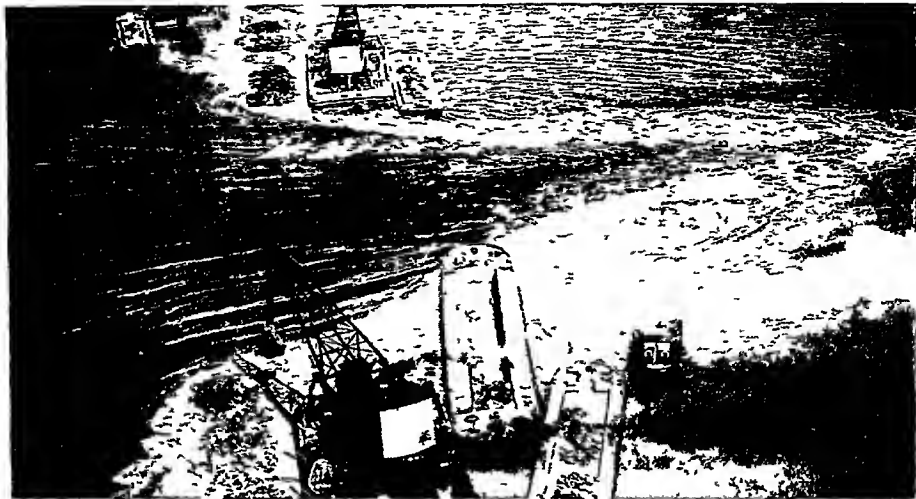
Today the Dutch are a commercial people, dealing in coffee, cocoa, chocolate, and tropical spices from their wide colonial possessions in the East Indies (see East Indies), the West Indies, and South America Holland once possessed a far greater colonial empire, and still controls colonies which are in area more than 50 times greater than the little land that rules them



MIDDELBURG—CAPITAL OF THE NETHERLANDS PROVINCE OF ZEELAND

This ancient city of the Netherlands stands nearly in the centre of the Island of Walcheren, about four miles from Flushing, and is today a prosperous manufacturing centre The town contains many old houses, but its chief pride is the Stadhuis or town hall, in the Grote Markt (Great Market) seen here from the air It is a Gothic building dating from the early 16th century, and the tower is 180 feet high The elaborate facade is ornamented with numerous statues of the Counts of Holland

Photo: A. J. M. Netherlands



HOLLAND'S NEVER-ENDING STRUGGLE AGAINST THE SEA

For ages Holland has been waging war against the encroachment of the sea, and one of the greatest tasks has been to drain the Zuider Zee, a huge tract which was flooded when the sea swept inland more than 500 years ago. Today modern machinery is gaining the mastery over the water, and thousands of acres of rich farming land are being won back from its hold. Above we see the last gap of the great dam between North Holland and Friesland, eighteen and a half miles long, just before it was closed in 1933. The photo clearly shows the strong current running at high tide.

Photo Netherlands Travel Bureau

Chief among Holland's imports are iron and steel, textiles, coal and coke, timber, machinery, wheat, corn, and linseed, and amongst its exports are meats, textiles, butter and cheese, eggs, coal and coke, wireless equipment, and vegetables.

This low, wet country with its sweet pastures is one of the world's best known dairies. The

people make thousands of pounds of butter and cheese. The Dutch have in times past gambled in tulips, as our own financiers gamble in stocks and shares, and these, together with hyacinths and other bulbous plants, form an important industry as the raising of vegetables. Dutch horses are also noted. No other part of the world has a greater harvest per acre of wheat, rye, and oats. Potatoes, sugar beets, flax, and barley are other crops. The farms are small, some no larger than two acres, so that little machinery is used on them, instead, they are intensively cultivated by

hand. Wood and stone are so scarce that farmers divide their fields with ditches or hedges. The sturdy seaside fishermen net large catches of herring, flounders, eels, oysters, and mussels. Coal is mined in the southern province of Limburg. The country has few other minerals, except for peat and salt, because it is made up chiefly of soil brought down by rivers.

The machine age did not progress in Holland until the end of the last century, being handicapped by the lack of iron and coal. Holland is one of the foremost shipbuilding nations. Cotton weaving, diamond cutting, flour milling, and printing are leading industries, and machinery, woollen goods, condensed milk, and chocolate are important products.

The ever-present menace of the grey sea waters has made the Dutch serious, hard-working, prudent, and watchful. An intensely strong patriotism has arisen, too, out of their common danger.



DUTCH DRESS

Here is a Zeeland girl, wearing national costume, sitting under an old archway at Veere, in the Island of Walcheren.

Photo J. G. van Agteren



PROCLAIMING THE BIRTH OF PRINCESS BEATRIX

About the Court of the Netherlands much of the pageantry of old days still persists on State occasions, though the ordinary life of the Royal Family is devoid of unnecessary ceremony. This photograph shows heralds in quaint medieval costumes, blowing a fanfare as they passed through the streets of Amsterdam on January 31, 1938, to proclaim the birth of a daughter to Princess Juliana (heiress to the throne) and her husband, Prince Bernhard.

and the constant need to protect the dykes. A saying goes, "God made the world, but the Dutch made Holland." The Dutch dykes along sea and river are among the world's great engineering achievements. The sea itself has tossed up a natural barrier in the sand dunes which line the coast. The Dutch reinforce these dunes with dykes built of stone, clay, and earth on foundations of concrete posts or long wooden piles. The stork is liked in Holland because the bird eats the dread teredo, a worm which bores into the piles. Some of the larger sea dykes, 200 or 300 feet wide, are as tall as three-storey houses, with highway or railway running on their tops. The rich farm lands, wrested from the waters and protected by the dykes, are called "polders." Excess water is pumped off them into the canals. Much of Holland has been reclaimed in this way to support a rapidly growing population, already 667 people to the square mile. Although small farms are still numerous, the movement of the population towards the cities has been increasing rapidly in recent years.

In Holland, you see bright peasant cottages—some with blue walls and yellow roof, others lavender and rose, made brighter by gay-coloured window blinds. And always there is a neat little garden in front, often enclosed by a hedge clipped in bird and animal shapes. Dutch homes are usually of brick, because wood and stone are scarce, and their roofs are

tilled or thatched. Barn and house are frequently under one roof to save space—the thrifty family at the back, the cattle in front, in quarters as clean as the house. The walls of the rooms are gay with tiles and bright paint.

Clothes, food, and even the beds of the home-loving family are kept out of sight in big wall cupboards. Stoves and open fires are kept going, for the climate is damp and cool with severe cold in winter and but few hot days in summer. Outside the house are rows of wooden shoes, or "klompen," which the country folk wear with woollen socks and straw because of

the damp ground. They walk about the house in stockinged feet or slippers. Boats are tied in front of houses along the canals as commonly as motor-cars are parked in other countries.

The cool climate and hard work give the Dutch enormous appetites, and they eat three wholesome meals a day, besides their morning coffee and afternoon tea. The cities have running water from the springs welling up at the base of the coast dunes, but the villagers go to the village pump for water.

Travel by Boat and Bicycle

Canals and rivers provide the chief means of transport for both passengers and freight. Besides the coast-line of about 200 miles, there are over 4,500 miles of navigable waterways, as compared to about 3,000 miles of roads—narrow and usually of brick—and about 2,300 miles of railways. Bicycles are so numerous that they actually cause traffic jams in the larger cities. Bicycles are easy to ride in this flat land, and besides they require neither garages nor fuel, literally everybody rides awheel, to work or for pleasure, and bicycle "parks" are specially provided for shoppers, church-goers, cinema-goers, and so on. In the winter old and young people skate continually, even making long trips on the frozen canals between the towns.

In the Middle Ages the present kingdoms of Belgium and the Netherlands were a group of disconnected counties, duchies, and other

feudal districts, some of them forming part of France, and some part of the Holy Roman Empire. Gradually these passed into the hands of the Burgundian dukes, and Charles the Bold sought unsuccessfully to weld them together and create of them a border kingdom between France and Germany (See Charles the Bold). The marriage of his daughter Mary to Maximilian of Austria brought the rule of the Hapsburgs to the "Low Countries" (Netherlands), as this whole group of territories was then called. On the abdication of Charles V in 1555, they passed to Philip II of Spain.

Rebellion against Alva

Against the political and religious tyranny of Spain, culminating in the infamous rule of the Duke of Alva and his "Council of Blood," an armed revolt began in 1568. But the ten southern provinces were Catholic in religion, while the seven northern ones were Protestant, so divisions crept in. In 1579 the Protestant provinces formed the separate Union of Utrecht, and thenceforth were usually called the United Provinces, sometimes the Dutch Netherlands. In 1581 they issued their formal declaration of independence. In 1609 Spain signed a truce virtually acknowledging the Provinces as independent, but formal peace did not come until the Treaty of Westphalia (1648).

Until the Dutch wars with Great Britain 1652-54 and 1664-67, the United Provinces

were the greatest commercial and maritime state in the world. The attempt of Louis XIV of France (in 1672-78) to conquer the Netherlands inflicted another serious blow on the Provinces. The aristocratic republic definitely ended, and the office of "stadtholder" became hereditary in the House of Orange in 1747. When the wars of the French Revolution broke out, the French revolutionaries overthrew the rule of the House of Orange and made the Netherlands again a republic (1795). Napoleon set his brother Louis over it as king (1806-10), but later felt obliged to annex the land directly to France. The Congress of Vienna restored the Netherlands as a kingdom under the House of Orange, and added to it the southern provinces (Belgium) in an ill-fated union. This connexion ended when Belgium revolted in 1830, and proclaimed itself a separate kingdom.

Slavery in the Dutch West Indian possessions was abolished with compensation to the owners in 1863. In 1890 the death of King William III, without sons, brought to the throne his little daughter, now Queen Wilhelmina. The government is a constitutional monarchy. In the tremendous upheaval of the great World War the Netherlands maintained its neutrality. But it temporarily fell to the Nazi invaders in May 1940 when the Royal Family and the Government sought refuge in Britain.

How the Sea saved Leiden from Spain

LONG, long ago—more than 300 years, in fact—grim, fierce Spanish soldiers were besieging the quaint Dutch city of Leiden. For days and weeks and months they had surrounded the city. The people within were starving. All day and all night children cried for food, but there was no bread left in the city. Hans and Gretchen sacrificed their pet dogs to feed the people. The leaves were all picked from the trees and eaten. But still the people would not surrender to the Spaniards, who were seeking to restore the hateful rule of the Spanish king and to put down with fire and blood the Protestant religion.

Then one day carrier-pigeons flew in to the besieged city. On their legs were found messages from the brave leader of the Dutch, William of Orange, saying that the dykes which held back the ocean had been opened and the ocean was coming to drown out the besiegers. Oh, how the people rejoiced! They fired cannon, and beat drums, to show their joy.

When the Spanish commander learned that the dykes had been opened, he was afraid. But officers laughed at his fears. "William of Orange may rule the hearts of his country-

men," they said, "but he cannot rule the ocean as well. No one but a crazy man would think it possible to call the sea from its bed across 22 miles of level land to the walls of an inland city."

In the centre of Leiden, on its highest point stood a tower. Many times a day the people climbed to the top of this tower, straining their weary eyes seaward to discover if the ocean was coming to their help. They could not see it, and hope grew faint as day after day wore away and no one outside Leiden seemed to remember them.

At the end of August, the pigeons carried to their brave leader, William of Orange, a message of despair from Leiden. "We have surely been forgotten," they wrote. "If help does not come soon, we must all perish." Back came the cheering answer. "Rather will we as a whole land and all our possessions perish in the waves than forsake thee, O Leiden!"

And it was true. The Dutch were busy collecting ships and supplies to help the suffering people. At last all was ready and the fleet set sail. Over the new sea made by opening the dykes the ships sailed until they were only



WHERE HOLLANDERS GO TO COLLEGE IN LEIDEN

Leiden is a very ancient Dutch city, and at one time its weaving establishments were very important. Today Leiden, though it still has considerable industries, is above all an academic town. Its university, seen above, is the most important in Holland, and was founded in 1575 as a reward to the town for its stout resistance against the Spaniards.

Photo Netherlands Travel Bureau

five miles from the city. But here they were stopped. The water was too shallow for the ships. The wind was against them, too, for it blew steadily from the east and drove the water back towards the ocean instead of heaping it up into an inland sea.

In Leiden things were at their worst. The people knew that their fate depended on the wind. Then eager eyes were fastened on the weather-vane, and earnest prayers were sent up that the wind might change. But still the vane pointed obstinately to the east. If help did not come soon it would be too late. Scores of people were dying of starvation every day.

Rats and mice had grown to be delicacies.

The Spaniards threw taunts into the city—"As soon expect the Prince of Orange to pluck the stars from the sky as to bring the ocean to the walls of Leiden." Immediately the brave men of Leiden sent back the bitter retort, "Ye call us dog-eaters, and it is true. So long, then, as ye hear dog bark or cat mew within the city, ye may know that the city holds out."

Then from the north-west came a wind which freshened to a gale, veering to the south-west. The waters of the North Sea were driven and thrown madly landward, and poured through the gap cut in the dykes.

In a few hours the water about the rescuing vessels had deepened. On the fleet sailed, through the branches of drowned orchards and the chimneys of buried cottages. It was midnight, pitchy black, and with the storm howling on every side. Somewhere in this blackness the Spaniards were fleeing before an enemy that they could not fight. Many were caught by the advancing waves. In Leiden there was no sleep that night, and early the next morning all were out to see the fleet sail up to the starving people rushed to the wharves, snatching the bread thrown to them in generous measure from the vessels. It was the first wholesome food they had tasted for two months.

The burst of welcome over, everyone fell into solemn procession and turned toward the great church to thank God for His wonderful deliverance. As a reward for the city's courage, William of Orange offered its brave people their choice of a grant for a university, or an exemption from taxes. They chose the former, and the University stands today as a monument to their bravery.

GLORIOUS ART OF THE NETHERLANDS



Jan Vermeer of Delft who painted this lovely Girl reading at a window is one of the three great masters of the Dutch School and his pictures are extremely rare In this one all the qualities for which he is deservedly famous are visible simplicity of design a setting in the interior of a house warm almost glowing light and above all a gentle grading of tones with no strong direct contrasts and yet a truth to life that is almost startling

Breda Art Gallery photo Alinari



SUPREME EXAMPLE OF THE ART OF THE TWO FLEMISH BROTHERS VAN EYCK

The paintings of the brothers Van Eyck show the full flowering of the glorious Flemish school. Here is a part of what is often considered to be their greatest masterpiece, a huge altar-piece done for the burgomaster of Ghent. This consisted of some twenty panels, of which that shown here, "The Adoration of the Lamb," is the lower central one and has given its name to the whole work. The realism of these early Flemish painters is here seen to advantage, while we cannot fail to notice their truth to Nature, and the care with which every flower and every leaf is depicted. The picture is a whole in an allegory—one of a great class of paintings by which the teachings of the Church were brought home to the humbler people of the cities of Christendom. This work was done in the first quarter of the 15th century, it was begun by Hubert van Eyck who died in 1436 before its completion, and finished by his brother, Jan.

Landscape of St. Bavo's Church, Ghent. Photo. Yensell



MOVEMENT AND GRACE IN AN UNUSUAL WORK BY RUBENS

Rubens was famous for his figure studies and religious paintings but everything he did was imbued with the same amazing life and movement. In few of his works however are these features so evident as in this great "Dance of Peasants". Notice the skill with which the artist has interwoven the pattern of his dancers using the horizontal lines of the outstretched arms of the left hand quartet to give the impression of speed and movement to the right of the picture where the action is slowing up, there is less movement but one outstretched arm is used to link the sides of the broken circle together.

Inside Gallery Herald photo Andrea

ONE OF REMBRANDT'S MANY MASTERPIECES



"A Man in a Golden Helmet" is the title of this painting, considered one of Rembrandt's greatest works. Dimly-lit portraits such as this, characteristic of the greatest of all the Dutch masters, would seem to offer small scope for the expression of tremendous gifts—but one has only to look at it to see the character which the artist finds in his sitter's face, and the skill with which he transfers it to the canvas for our pleasure.

Helm Gallery photo Bruckmann

HOMELY STUDY BY A GENIUS OF PORTRAITURE



Hans Holbein is best known for grand portraits such as the famous 'Laughing Cavalier' (see page 2003) in which the detail is subservient to the general effect but in this delightful 'Nurse and Child' you see with what care and skill he could reproduce in paint the complicated lacework and embroidery of a small child's dress, ruffles and headgear. There is a great charm too, in the attitude of the nurse who is keeping the child amused.

Berlin Gallery photo Bruckmann

OUTDOORS & INDOORS IN 18th-CENTURY HOLLAND



Perhaps no Dutch landscape is so well known as "The Avenue Middelharnis" by Meindert Hobbema's most popular painting. In design alone it is an outstanding work, for there are few painters who would so courageously tackle a subject of this type. David Teniers (the younger), artist of the "Corps de Garde" (The Watch) seen below, provides a link between the Flemish and Dutch schools; for while he himself belonged to the former, he was followed in manner by many members of the latter school.

Bottom: from the painting in the possession of Viscountess Swinton; top: National Gallery, London.

DUTCH LIFE AS DEPICTED IN ITS ART



The Dutch marine painters form a group apart, unapproached in their special type of painting by those of any other nation. The upper picture is by J. van de Velde, member of a famous family, and is entitled, "Quiet Sea with Shipping." In winter the Dutch of yesterday (like those of today) betook themselves to the ice which covered their innumerable canals and waterways and provided subjects for paintings of another type in winter by Abraham Beerstraeten is a typical example of this genre.

Top: The Harbor of Rotterdam. Bottom: from the painting in the possession of Sir W. H. St. John.



REALISM AND DETAIL EXPRESSED IN DUTCH STILL LIFE

An important school of Dutch art included the painters of flower-pieces many of whom displayed wonderful skill. In this "Vase with Flowers" by Jan van Huysum, you see not only flowers, but fruits, insects, and even a bird's nest, all displayed with the same astonishing realism which sought to portray even the drops of dew on individual blossoms and the blemishes on the wings of the insects. For beauty of colour and skill of composition, too, these pictures have seldom been rivalled in the world of still life.

National Gallery, London

NETHERLANDS

FAMOUS DUTCH & FLEMISH PAINTERS

Though not notable for its achievements in the other arts, Holland has given birth to some of the world's greatest painters, members of the famous Flemish and Dutch schools, their names are chronicled below

Netherlands. Its Art The art of the Netherlands falls into two periods, so distinct as to be virtually separate phases in the history of art—the Flemish and the Dutch. The northern Gothic architecture did not lend itself to mural decoration as did that of Italy, and painting was therefore done on wooden panels, such works being used largely for decorating the glorious town halls and guild-halls as well as the churches of Flanders. Yet the advent of Flemish painting as we know it was delayed until the second half of the 14th century, when in Italy the new birth of art was already accomplished (See Italian Art). Then, suddenly there appear the brothers Van Eyck, Hubert (c. 1366-1426) and Jan (c. 1385-1440). The former, inspired apparently by Italian works, began a famous altarpiece at Ghent which was completed by his younger brother Jan, artistically inferior, is famous as the first to realize and put into practice the possibilities of oil painting. In the National Gallery, London, is his masterpiece, depicting Jan Arnolfini and his wife.

Contemporary with the Ghent school was that of Brussels, led by Roger van der Weyden (c. 1400-1464) and Hans Memling (c. 1430-1494), in many ways the greatest of these early Flemings. Ranked by some with the famous Italians whom he preceded, Memling threw off the northern stiffness and heaviness of his predecessors, and his paintings reveal a softness and grace new to northern art. He is well represented in our National Gallery. The astonishing thing about this entire Flemish school is its apparently sudden rise and development over a very short period, for even the great period of Italian art

took a century to evolve from Cimabue to Fra Angelico. Other artists who reached a very high standard were Hugo van der Goes (c. 1435-1482), Dierick Bouts (c. 1410-1475), and Gerard David (c. 1450-1523), all of whom were actually Dutchmen, and Petrus Christus (c. 1400-c. 1473), originator of Netherlandish genre pictures.

In the 16th century Flemish painting suffered to a considerable extent through the work of a group of painters who have been termed



PORTRAIT MASTERPIECE BY MEMLING

Perhaps the greatest master of the early Flemish painters was Hans Memling, whose easy and graceful style is seen to great advantage in his beautiful portraits. This one is of Martin van Nieuwenhove and it occupies the right-hand panel of a diptych painted for him by Memling in 1477; the left panel showing the Virgin and Child. "St. John's Hospital" Bruges photo "Gazette"

"Italianizers," because they overwhelmed their native art with the lusciousness and richness of the Italians. Their work is seen in the paintings of Mabuse (c. 1472-1532) and Van Orley (c. 1490-1540). Alongside of them, however, several very fine schools of native Flemish painters were flourishing. At Antwerp Quentin Matsys (1466-1530) laid the foundations of a new *genre* school whose colour was also far more brilliant than that of earlier Flemings.

Patinir (c. 1475-1524) and Hendrik Bles (c. 1480-c. 1550) were perhaps the first of all real landscape painters, in whose pictures Nature is for the first time more important than Man. Patinir especially delighted in strange rocky shapes and broad rivers, with sky and distance alike done in a brilliantly cold, hard blue. Into these pictures (which you may see in the National Gallery) are introduced figures of the Holy Family or of early saints.

At Antwerp, again, worked the Brueghels, a family of *genre* painters who followed Bosch (c. 1460-1516) and are famous for the word detail of their paintings, in many of which the backgrounds are crammed with scores of little figures. Pieter Brueghel the elder (died c. 1570) was nicknamed "the Peasant," since he was best known for his strange and grotesque scenes of peasant life. His sons, Pieter (1564-1637) and Jan the Elder (1568-1625), were nicknamed "Hell-fire" and "Velvet," respectively, the former having done some notable pictures of the nether regions and similar *genre*, while the latter loved to depict in brilliant colours the gorgeous stuffs worn in his own time. Other followers of the various groups included Paul Brill (1554-1626), who carried on the landscape tradition, and the portraitist Antonis Mor (1512-1576), who worked a good deal in England. (See English Art)

World-famous Rubens and Van Dyck

Now, suddenly and with no great fore-runners, the mighty figure of Rubens appears on the scene of Flemish art. Peter Paul Rubens (1577-1640) studied under various masters, and, having spent some years in Italy, settled in Antwerp in 1608. There and elsewhere he executed an enormous number of paintings, remarkable for their size and their general excellence as well as for their actual number, even allowing for the fact that he was assisted by his best pupils, his achievement is colossal. He brought the full radiance of Italy—and especially of Venice—to the less emotional outlook of the Fleming, and united these with his own superb powers of draftsmanship and design. If he lacked the "soul" that makes painters of the very highest rank, he outdid every painter the North had produced in almost everything else. In religious paintings, in portraits, and in landscapes he was

alike excellent. His influence was naturally tremendous, yet he had only one great pupil, Anthony van Dyck (1599-1641). Van Dyck, who, like Mori and Rubens, was knighted in England, was a portrait painter above all things, and his finest works in the grand manner, in which he excelled, rank among the world's great portraits. Of his followers the most important were Philippe de Champaigne and Lely. (See French Art and English Art respectively)

Tremendous as was the figure of Rubens, he did not influence all the Flemish painters with his Italian ideas. Jordaens (1593-1678), who did excellent portraits and peasant *genre*, and Snyder (1579-1657), who painted fine scenes of animals and still-life of flowers and fruit, etc., upheld the native tradition.

Flemish painting was dying by the end of the 17th century, but links between it and the Dutch school are found by following the *genre* of Adriaen Brouwer (c. 1605-1638) and David Teniers the younger (1610-1690), both of whom painted the "low life" of the Low Countries. But Teniers raised this art to a rather pleasing and almost delicate one, such as was followed by the Dutch *genre* painters.

Franz Hals and Rembrandt

Before dealing with Dutch *genre*, we must note the two great portrait painters who brought the whole school into prominence. Although there had been a number of good painters before him, Franz Hals (c. 1580-1666) was the first master of the Dutch school. His "Laughing Cavalier" (see page 2003) is one of the world's best-known pictures, and gives a good impression of his work at its finest. His paintings reflect closely the life and prosperity of his country. Contemporary with Hals was Holland's greatest master, Rembrandt.

Rembrandt van Rijn (1606-1669) was a man whose work in all sorts of ways is equally remarkable. As portraitist he excelled, he painted some glorious religious pictures, as a landscape artist he was almost equally good, and as an etcher he has never been approached. Yet, like Rubens, he seems to have lacked that sense of spiritual beauty which makes the greatest of the Italian masters.

One Dutch painter, Honthorst (1590-1656), stands out because he was strongly influenced by Caravaggio, but few showed any influence other than that of their own school. There were portrait and *genre* painters, followers of Teniers, such as Ter Borch (1617-1681) and Adriaen van Ostade (1610-1685), whose scenes of peasants outside towns have a great reputation. Ostade, too, was an etcher in almost the same class as Rembrandt himself. Isaac van Ostade (1621-1649) did similar themes with rather more of a landscape background. Interiors

provided the setting for the very neat and detailed work of Gerard Dou (1613-1675) and Metsu (c 1630-1667), and their numerous followers. On a slightly higher level stands Nicholas Maes (1632-1693), whose figures have considerably more character than those appearing in earlier works, and from him branch off the works of Jan Steen (c 1626-1679), Pieter de Hooch, and Vermeer. Steen painted rather larger pictures than most of these "little Dutch masters," and there is a glorious realism in his carousing peasants and jolly, greedy little boys. De Hooch (1629-c 1683) excelled in the simple scenes of the Dutch houses, with their tiled floors and neat, perfectly arranged furnishings. It is when we come to Jan Vermeer of Delft (1632-1675) that this art reaches its highest pitch. Vermeer, whose paintings are of great value and rarity, has come into his own only within the last few years. His greatest point is perhaps a warm, glowing sunlight which illumines the beautiful rooms in which sit his young ladies, often engaged in some musical occupation. In technique, as in design and feeling, he was a master, while his solitary landscape—the "View of Delft"—attains equal greatness in its own way.

Considered the first of the Dutch landscape school, Jan van Goyen (1596-1656), produced work with a somewhat browner, more mellow tone than that of later members of this school. Among these were artists who specialized in cattle, such as Albert Cuyp (1620-1691) and Paul Potter (1625-1664), or in horses, such as Wouwerman (1619-1668), whose paintings have a great appeal for children. Philip de Koninck (1619-1688) did broader, greener landscapes,



CHARMING EXAMPLE OF A DUTCH INTERIOR

This painting by Pieter de Hooch, a great 17th-century Dutch artist, shows the fine draughtsmanship and the clever use of lighting which make his pictures so attractive. Interiors were favourite subjects of the Dutch painters of this period, and De Hooch was one of the greatest masters of the "genre" painters—painters who favour scenes drawn from rustic or peasant life. His pictures were almost always small. This example is now in the National Gallery, London.

Photo: Vancell

often with a fine effect of sunlight, and these lead on to the landscapes of Jakob van Ruysdael (c 1628-1682), perhaps the finest Dutch painter in this manner. Ruysdael and Hobbema (1638-1709) both interested themselves in trees to a greater extent than their contemporaries, while Hobbema, though less romantic than Ruysdael, excelled as a painter of skies.

The Dutch marine painters are deservedly even more famous than the landscape artists. Of them, Adriaen van de Velde (1636-1672), who chose shore landscapes, and his brother Willem (1633-1707) are perhaps the finest. Their father was another Willem, who is more famous as an accurate marine draughtsman than as an artist, he did for Charles II and James II numerous drawings which are almost reports

of the sea-fights of the Restoration period, although at one time the members of this family were fighting against Britain! A follower of the Van de Veldes who paid more attention to sky effects was Jan van de Cappelle (c 1624—c 1675), while ships in more lively seas occupied the attention of Backhuysen (1631—1708). Besides these marine painters, there were the still-life painters and especially the masters of the truly marvellous "flower-pieces," in which great masses of richly-coloured blossoms are grouped together in a jar, while over and among them flutter butterflies and all manner of other insects. Jan van Huysum (1682—1749) is perhaps the most famous of these, others are the De Heem family, and Hondocoeer (1636—1695), who painted dead game.

Since the early 18th century Holland has produced few painters of note. In the 19th century many artists appeared, of whom Josef Israels (1824—1911), Jacob Mauis (1837—1899), and Anton Mauve (1838—1888) deserve mention. Of more importance is Jongkind (1819—1891), in some ways a forerunner of the Impressionists, but it is hard indeed to realize when one looks at his paintings, that even he lived at the same time as one of the most important of all modern masters, Van Gogh, who was born in 1853 and died in 1890. Like Jongkind, Van Gogh belongs, artistically, to the French rather than to the Dutch school. (See also French Art, Impressionism, and articles on Hals, Rembrandt, Rubens, etc.)

Nettle. The nettle plant has a bad reputation, for the stinging hairs with which it is covered pierce the skin when touched and give forth an acid juice which often causes much inflammation and pain. If, however, one is careful to grasp the weed in such a way that the hairs are pressed to the stem, no pain ensues.

The nettles proper are perennial or annual herbs with occasionally shubby bases, and make up the genus *Urtica*. Several trees of different genera, especially the giant nettle of Australia, are given that name.

In many countries nettles when boiled have a special value as food for swine and poultry.



MOST PAINFUL NETTLE

There are several species of nettles, not all of which have stinging hairs. Of those that do sting the common and Roman nettles are the best known, the latter, which has the worst sting of all is shown here, with its ball-like masses of flowers.

Photo A. H. Deans

The roots boiled in alum produce a yellow dye, and the stalks and leaves give a beautiful green dye. The fibres (called "lanne") of different species are used for making rope, yarn, cloth and lace.

Nevada, USA. This is one of the largest yet most thinly populated States in the whole of the U.S.A., containing only 91,000 people in an area of 110,000 square miles. The peaks of the Sierra Nevada ("snowy mountains") border the western boundary, adjoining California, of the Great Basin of Nevada.

The largest town in Nevada is Reno (population, 18,000), notorious for its prominence in the divorce news, the State capital is Carson City (1,500). Partly within Nevada is the beautiful Lake Tahoe. Another feature of interest on the borders of the State is the great Boulder Dam on the Colorado River, which here separates Nevada from Arizona.

The principal occupations of the people are divided fairly equally between the mining of copper, silver, and gold, and cattle- and sheep raising, both of them extensively practised.

New Brunswick, CANADA. Nature and history have combined to cut off New Brunswick, Nova Scotia, and Prince Edward Island from the rest of the Dominion of Canada. The northern projection of Maine, U.S.A., thrusts far up between New Brunswick and southern Quebec. Thus the only communication by land is either across the territory of the United States or by a roundabout route. Despite these drawbacks, the importance of the ice-free harbours of St. John, New Brunswick, and Halifax, Nova Scotia, as winter outlets for the grain of the North-West has led to the construction of three railway lines linking the Maritime Provinces to the rest of the Dominion—the Intercolonial and the Transcontinental (now part of Canadian National Railways), and an extension of the Canadian Pacific across U.S. territory in Maine.

New Brunswick lies between the Gulf of St. Lawrence and the Bay of Fundy. More than 70 per cent of the people of New Brunswick live in the country, and agriculture is the leading

NEW BRUNSWICK

industry The chief crops are hay and potatoes. Of recent years dairying and cattle-raising have increased considerably.

These pursuits are carried on at the outer edge of the province, the centre of which is all one vast forest. Lumbering is the second industry of importance, and scarcely a stream of the network of rivers which covers New Brunswick hut has its saw-mill. The manufacture of wood-pulp is becoming increasingly

Area—27,985 sq miles, of which only 74 are water
Population, 408,200

Physical Features—A fertile plain, with a large area of dense forest in the centre, and a spur of the Appalachians in the north. Rivers include the St. John and the Miramichi. Grand Lake, and a few other lakes.

Products—Lumber, wood pulp, iron, coal and other minerals, fish.

Principal Towns—St. John (47,000), Fredericton (capital, 8,800)

important, and there are several cotton factories. Coal is found in various parts of the province, and natural gas and oil are exploited on a small scale.

But New Brunswick's chief fame is as a summer playground. It is one of the favourite resorts of the angler and the hunter, for its streams swarm with salmon and other fish, and in its great forests are all kinds of game, both large and small—moose, caribou, deer, wolves, foxes, otters, mink, rabbits, geese, ducks, and partridges. The fisheries along the 600 mile sea coast are also valuable, ranking next to those of British Columbia, Newfoundland, and Nova Scotia.

The first settlement was made by the French on the Bay of Chaleur in 1639. The territory, combined with Nova Scotia under the name of Acadia, was ceded to the English in 1713, and in 1755 numbers of the French inhabitants were deported.

Many of the present inhabitants are descended from loyalists who emigrated from New England in 1784-85, though an other large group is of old French Acadian stock. The chief city is St. John, Canada's principal winter port, lying at the mouth of the beautiful St. John River. About 80 miles up the river is Fredericton, the capital, the centre of a fertile farming region and the seat of growing

NEWCASTLE

manufactures. Here also is situated the University of New Brunswick.

Newcastle-upon-Tyne. "Carrying coals to Newcastle" is an old ironic saying. We appreciate its meaning when we sail up the narrow, crowded waters of the river Tyne and come to this bustling city, at whose docks great steamers and barges are endlessly engaged in loading coal for export to all parts of the world, for Newcastle lies between the coal regions of Durham and Northumberland (it is in the latter county), and is one of the most important coal-shipping centres of Europe.

The city's shipbuilding yards and locomotive, engineering, and ordnance works are among the largest in England. George Stephenson was born near Newcastle, and the city was associated with many of the first steps in the development of the railway system. Its factories turn out, among other things, vast quantities of soda, vitriol, bleaching-powder, salt, and other chemical products, and also earthenware, cement, grindstones, fire-brick, and refined lead. It is also a large fruit and vegetable market.

Newcastle was the site of an old Roman fort defending the eastern end of the wall that Hadrian built across Britain. Its modern name of Newcastle came in the 11th century when Robert, the son of William the Conqueror, built a castle here. A century later Henry II rebuilt the castle, of which parts still remain, with walls eighteen feet thick, and the Black



CHIEF PORT OF NEW BRUNSWICK

The city of St. John, New Brunswick, is one of the chief winter ports of Canada, beside being the Atlantic terminus of the Canadian Pacific railway. It has a good natural harbour and its docks can accommodate the largest ships. This photograph was taken from the head of the harbour, looking out to sea.

Courtesy of the High Commissioner for Canada



FROM NEWCASTLE TO GATESHEAD

T. General

The newest of the six bridges crossing the Tyne at the great industrial city and seaport of Newcastle is that shown above. Opened in 1928, it resembles the Sydney Harbour Bridge (see page 650), and was actually built by the same engineers. On the extreme right is part of the Swing Bridge, also for road traffic.

Gate—a fine specimen of the Norman stronghold, it is now a museum of the city's history and antiquities.

Not far from the castle is the cathedral of St Nicholas, of which the principal feature is a

Newcastle is joined by several fine bridges. Residential suburbs include Jesmond and Gosforth. The population of Newcastle-upon-Tyne is about 283,000. There is another Newcastle in Staffordshire, known as Newcastle-under-Lyme.

GREAT BRITAIN'S OLDEST COLONY

The first land of the New World to be discovered by English navigators and the first country on the globe to be colonized from England, Newfoundland has a proud history for such a small island.

Newfoundland. This rugged, rock-bound island, lying at the mouth of the Gulf of St. Lawrence, the gateway to Canada, was the first land discovered by John Cabot in the New World (1497). The immediate result of Cabot's voyage was the growth of the cod-fishing industry, which first drew Englishmen across the wide ocean and helped to make them a nation of seafarers. As early as 1578 about 400 fishing vessels were resorting each year to the Newfoundland fishing banks.

This early importance of Newfoundland was due chiefly to the great submarine plateau called the Newfoundland Banks, which extends about 200 miles off shore and comes within 100 or 200 feet of the surface.

Here is an inexhaustible supply of plankton, the minute floating organisms of the sea on which the larger ocean creatures feed, and while this flood of food continues to drift down from the Pole and up with the Gulf Stream there is little danger that the cod supply will be diminished.

The cold, foggy coasts of the island were not, however, favourable to settlement, and the early attempts of Sir Humphrey Gilbert (1583) and other Englishmen to found colonies met

with little success. By 1634 there were about 1,750 permanent British inhabitants, besides a nomadic fishing population of several thousands, of various nationalities.

The French, who held Canada, had long attempted to secure control of Newfoundland,

Extent—North to south, about 330 miles, greatest width, east to west, 316 miles. Area, 42,734 square miles. Population about 289,000.

Physical Features—Coast broken by fjords and island-dotted bays, Anguille Range and Long Range mountains in the west, and isolated peaks (highest point 2,084 feet). Principal rivers—Humber, Exploits, and Gander. Grand Red Indian, and Gander lakes.

Products—Fish (chiefly cod), lumber and timber products (paper), ships, iron and copper and coal, hay, potatoes, cabbage, turnips, oats.

Principal City—St. John's (capital, population, 39,000).



NEWFOUNDLAND'S NARROW NECKED PORT

St John's Newfoundland possesses one of the most remarkable natural harbours in the world, shown here viewed from the air. It is approached through the Narrows, a channel about half a mile long running between sandstone cliffs which in places rise to a height of 500 feet. At the narrowest point, between the Pancake and Chair rocks, it is only 400 feet wide but ocean-going ships can pass through it at all states of the tide.

1 photo Royal Canadian Air Force Crown Copyright

and though the Treaty of Utrecht in 1713 recognized the sovereignty of Great Britain, France was given the right of catching and drying fish on the northern and western shores. These rights in the "French shore" were retained by France until 1904.

The fisheries still form the chief industry of Newfoundland. Of late years the government has encouraged agriculture, and the copper and iron mines have become of importance. There are large deposits of coal and petroleum, and the extensive forests provide lumber for several paper and pulp mills and for shipbuilding.

The interior and the western coast are delightful in summer and possess a mild climate in winter. The fogs rarely penetrate inland. Innumerable lakes fringed with woodland dot the interior, and occupy nearly a third of the total area. Deer, lynxes, foxes, beavers, otters, hares, and game birds abound. The island is the home of the sagacious and gentle Newfoundland dog. The people of the island are mostly descended from the English, Irish, Scottish, and French fishermen who settled there long ago.

Newfoundland is a separate unit of the British Empire. It has a governor appointed by Great Britain and, nominally, an Executive

Council, a Legislative Council, and an elected House of Assembly. The administration and liabilities of Newfoundland were, however, temporarily taken over by the British Government in 1933, the Constitution of the former Dominion being suspended. Labrador (*qv*), on the American mainland, is also under the Newfoundland government. St. John's, the capital, is the centre of the codfish drying industry.

There are 800 miles of railway, the majority are Government lines. Various fertile sections of the island have been opened up by branch lines of railway. Steamers provide communication between different points along the coast, and between the island and the mainland. Newfoundland gained a new importance in 1937, when Port Botwood and Gander Lake were fitted out as bases for the Transatlantic air service.

New Guinea, AUSTRALASIA. This vast island—the third largest on earth—still keeps most of its secrets hidden from the outside world. The white people who have explored its coasts and ventured up its rivers divided the island among themselves long ago. But by far the larger part of its 300,000 square miles is still occupied only by savages, and head-hunting

NEW GUINEA

raids and cannibal feasts continue with little possibility of interference

New Guinea lies north across the Torres Strait from Australia, and just below the Equator (For map, see East Indies) It stretches east and west about 1,500 miles and is about 450 miles across at its widest. Greenland and Australia are the only larger islands. The western half of New Guinea belongs to the Netherlands, the eastern half, to the British Empire as a dependency of Australia. The number of natives has been estimated at about one million. There are fewer than 10,000 settlers, including whites, Chinese, Malays, and others.

A backbone of mountains, with snow-clad peaks, runs nearly the entire length of the island. Rugged spurs extend from this backbone, cutting up the land into deep valleys and isolated plateaux. Great rivers flow down from the mountains, crossing broad belts of forest and swamplands to the sea. The most important river is the Fly, which winds 800 miles southward to the Gulf of Papua, next are the Sepik and the Mamberamo, which empty into the Pacific Ocean on the north. Lakes nestle in hills and valleys, or form chains in the lowlands along the rivers. Where mountain spurs reach the sea, the coast is high and rocky, elsewhere it consists mostly of tidal swamps.

In the rainy seasons terrific storms sweep the island. In the lowlands even the dry seasons are damp enough for the giant grasses and the

forest trees to continue their lush growth. Acacias, eucalyptus, cypress, and palms of many kinds grow here, along with countless trees that have no English names. Among their branches hang hundreds of varieties of rare orchids. Great creepers and climbing vines form a tangle so dense that explorers who leave the rivers to cut their way through the forests count two or three miles a day a fair rate of travel. The very soil seems to be alive with the hum of millions of insects. Clouds of mosquitoes hover above water teeming with crocodiles and huge leeches. Brilliant butterflies flutter among the trees.

Strange New Guinea Animals

The wild life of New Guinea resembles that of Australia, including egg-laying mammals called "spiny ant-eaters," and several marsupials such as the wallaby (a miniature kangaroo), the ring-tailed opossum, and the bandicoot. The wild pig is New Guinea's largest known mammal. Huge fruit-eating bats abound. Conspicuous among the birds are the ostrich-like cassowary, so powerful that it can kill a dog with a blow of its foot, the egret, the bower-bird, and the many species of birds of paradise. Lizards, some of great size, and snakes both harmless and poisonous exist nearly everywhere on the island. In the coastal waters live the sea mammals called "dugongs," and great turtles.

From district to district the natives of New Guinea show great contrasts in appearance, customs and language. Some are black as negroes,

others are no darker than a well-tanned white man. Some are six-foot giants, others, dwarf-like pygmies. A tribe with broad noses and thick lips may have long-nosed and thin-lipped neighbours. There are small groups that live like hunted animals, without settled homes and with no more possessions than they can carry on their backs. There are also great tribes with an elaborate social organization and a remarkable skill in architecture, boat-building, sculpture, painting, weaving, and pottery-making. Measured on the scale of the history of white



SHOOTING FISH IN NEW GUINEA

In the south-eastern part of the island of New Guinea, known as the territory of Papua, the natives have a peculiar method of catching fish by shooting them with bows and arrows. Above, small boys of Manu Island are seen busily engaged in shooting in this manner fish which have been left by the receding tide in the pools of a coral reef.

civilization, the culture of the New Guinea natives ranges from that of the "dawn men" of Europe to that of the lake dwellers of Neolithic times (See Man)

The best-known of the natives belong to the so-called "Papuan" types. They are sooty brown to deep black, with long frizzly hair. Many of the Papuans have oval faces with prominent noses, high cheek-bones, and high foreheads. The men are nearly naked, their bodies are decorated with knife scars in intricate patterns, made when they graduate from boyhood. They wear necklaces of teeth and shells, ear-rings, feathered head pieces, and cassowary bones thrust crosswise through the middle cartilage of the nose. The women generally wear grass skirts and much simpler ornaments than the men.

The typical Papuan village lies near a river bank, hidden behind a screen of trees. The buildings are well made of log frames with thatched walls and roofs. Near the river are concealed the great war canoes hollowed out of tree trunks with axes and adzes made of stone or shell. Gardens fringe the village where the women raise yams, taro, bananas, and sugar-cane.

The family houses surround a long club house and a mound, called a *dubu*, strictly reserved for men. In front of the *dubu* is an open space where the wild tribal song dances are held to the intricate rhythms of drums. Inside the *dubu* hang marvelously carved and painted canoe paddles, bows and arrows, spears, and daggers. Most prized of all are the exhibits



NEW GUINEA NATIVES IN THEIR NEST-LIKE HOMES

Some of the New Guinea natives have such troublesome neighbours that they are obliged to live in houses perched up in trees like those shown above, so arranged that whenever they go "upstairs" they can pull the stairs up after them. The houses are built of interwoven sticks and are covered with long grass. These tree dwellings are common on the New Guinea coast.

of human skulls and smoked heads, each one representing a victim killed and perhaps eaten. Cannibalism and head-hunting have ceased near the coast, but they persist in remote areas.

Portuguese and Spanish adventurers of the early 16th century were probably the first white men to sight the coast of New Guinea. In 1606 a Spaniard, Luis de Torres, sailed the strait between New Guinea and Australia which bears his name. The Dutch annexed the island in 1793, and Germany and Great Britain declared

protectorates in the eastern half in 1884 British New Guinea passed into Australian control as the Territory of Papua in 1906, and German New Guinea went to Australia as the Mandated Territory of New Guinea by decision of the League of Nations in 1921.

As elsewhere in the Pacific the oldest resource of New Guinea is copra, the dried meat of the coconut. Rubber and sisal hemp are also raised on plantations under European direction. The forests teem with valuable timber, as yet largely unexploited. Indications of petroleum have been found. The mountains, young and rugged like the Rockies, promise vast deposits of minerals and gems, and are already yielding some gold, copper, silver, and osmiridium. But tangled jungles and jagged cliffs bar the way to the mineral wealth. In 1934 over £1,500,000 of gold was mined in British New Guinea. Instead of railways, aeroplanes are used to carry stores and machinery to the mines and to transport the gold back to the coast for shipment.

Missionaries and government officials are slowly penetrating to the interior, and explorers by air are mapping regions hitherto uncharted. The prevailing policy is to pacify the natives without violence and to develop the interior with the aid of the many energetic tribes that dwell there. Few outsiders can stand constant hard work in the New Guinea climate.

Dutch New Guinea has its capital at Merauke on the southern coast and is administered as a province of the Dutch East Indies. The Mandated Territory of New Guinea includes, to the east, a part of the Solomon Islands and all the Bismarck Archipelago, comprising New Britain, New Ireland, and the Admiralty Islands. Rabaul (non-native population 1,900), on the island of New Britain, is the capital of the Mandated Territory. The Territory of Papua has its capital at Port Moresby on New Guinea's south-east coast and includes, to the east, the Louisiade Archipelago, the D'Entrecasteaux Islands, and the Trobriand Islands. The Tro-

biand natives have become famous because of the detailed studies of their customs and culture made by the distinguished anthropologist, Bronislaw Malinowski.

New Hampshire, U.S.A. One of the thirteen original states of the American Union, New Hampshire has an area of 9,341 square miles. Concord is the capital, with a population of 25,000. The largest city is Manchester (pop. 76,800).

The White Mountain region, occupying the northern half of the state, is a favourite tourist and holiday resort. One of its most picturesque spots is the wooded defile known as Franconia Notch, dominated by Profile Mountain, whose upper cliffs form the "great stone face" of a story by Nathaniel Hawthorne. Mount Washington (6,288 feet) is the highest peak. Abundant water-power is furnished by the Connecticut, the Merrimack, and other rivers. Although New Hampshire has the shortest coastline of the Atlantic states (about 18 miles), the state has considerable shipping. Portsmouth is its chief port.

The chief industries are the manufacture of boots and shoes and of cotton and woollen goods. Granite-quarrying, lumbering, and the making of wood-pulp for paper are important, and excellent fruit is grown, notably apples.

The first settlements were made in 1623, and John Mason, who was one of the principal grantees, gave to the colony the name of New Hampshire, after his native county in England. There were long boundary disputes, lasting over seventy years. The colony became a separate province in 1741. The population is about 465,000.

New Jersey, U.S.A. This is another of the thirteen original states of the Union. The area of New Jersey, which lies immediately to the west and south of New York, is 8,224 square miles. The capital is Trenton (population, 123,000), while Newark (population, 442,000) is the largest city. Places like Jersey City (316,000) and Hoboken are really "dormitory" suburbs for New Yorkers. Farther south is Atlantic City, which is a favourite all-the-year-round playground.



WOMAN OF NEW GUINEA

This Papuan woman slings her baby over her back, to leave her arms free for work, and the cradle she uses is a net-work bag. Dress forms an unimportant item in the New Guinea family budget!

NEW JERSEY

Along the north-western border are the Kittamy Mountains, a favourite summer resort South has a wide valley with farming lands famous for their garden crops, fruits, and poultry. Then comes a hilly region of limited agriculture and population. Farther south is a plain with large crops of potatoes, tomatoes, fruit, and the like. At the extreme south lies a coastal plain which embraces about half the entire state.

Among the great variety of New Jersey's manufactured products are silk, refined copper and oil, linoleum, pottery, sewing-machines, dye stuffs, and electrical supplies. Pottery and other clays, zinc, and iron are mined.

New Jersey was first settled by the Dutch, who occupied the eastern part of the state between 1614 and 1621. In 1664 England laid claim to the region about the mouth of the Hudson, and New Jersey was granted to Lord Berkeley and Sir George Carteret, who had been governor of Jersey in the Channel Islands. During the War of Independence New Jersey was the scene of some of the most dramatic events. The population is about 4,041,000.

Newman, John Henry, CARDINAL (1801-1890) When all else that Newman wrote has been for the most part forgotten, his name will still be kept alive by his well known hymn

Lead, Kindly Light, amid the encircling gloom,
Lead Thou me on.
The night is dark, and I am far from home,
Lead Thou me on.

Keep Thou my feet, I do not ask to see
The distant scene—One step enough for me.

These beautiful hymns have found their way into almost every heart and hymn-book. Newman composed them in 1833, while on shipboard returning to England from a voyage to the Mediterranean, before the religious questionings had arisen which led him from the Church of England to the Church of Rome.

Two years after taking his degree at Trinity College, Oxford, he obtained a fellowship at Oriel, "the centre of Oxford intellectualism." Always of a dreamy religious temperament, he became a clergyman of the Church of England as well as an Oxford tutor. He was a leading spirit in the famous "Oxford Movement," a High Church reaction which manifested itself in a series of "Tracts for the Times," of which



CARDINAL NEWMAN

Newman, besides being a great master of English prose, was a preacher who, without any mere rhetorical flourishes, carried his congregations with him by his spiritual fervour and deep sincerity.

New Mexico, U.S.A. This is one of the most fascinating States in the U.S.A. Not only do the Rocky Mountains and the Sierra Madre ranges run through it, but there are other features of very varied interest, such as the age old Indian pueblos or villages, the Indians themselves (Navajos, Pueblos, Apaches, and so on) in their own special reservations, the enormous Carlsbad Cavern within its National Park, and the ruined cliff dwellings of a prehistoric era. On the historic Rio Grande are huge irrigation works, cattle ranches, prosperous despite the lack of ready water. The capital of New Mexico is Santa Fe (population, 11,000). Albuquerque (20,000) is the only other considerable town making it the fourth largest in the U.S.A. the population is 423,000.

New Orleans, U.S.A. This great seaport, the outlet for the State of Louisiana and for the whole of the Mississippi basin, has two distinct sections. The older part is very picturesque in character, with a large creole (American born French

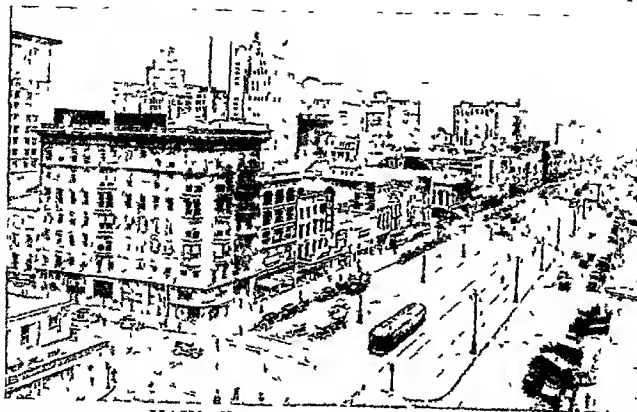
NEW ORLEANS

he was the chief author of the medieval Church restored in its power and grandeur gradually led this simple, sincere ascetic, with grave kind eyes and a thoughtful smile, to the Roman Catholic Church, which he called "a home after many storms." He was appointed a priest at Rome in 1845, and was appointed a cardinal in 1879. He died at Birmingham on August 11, 1890.

It was in his many sermons, lectures, and writings that Newman became one of the great religious forces of his day. The spiritual fervour, the searching subtle intellect, and the charm of his personality were supplemented by a fine prose style which for ease, clearness, and beauty has seldom been surpassed.

Among Newman's many important writings are his "Apologia pro Vita Sua" (1864) considered one of the classics of English prose, "Verses on Various Occasions" (1868), in which is included the beautiful "Dream of Gerontius", "An Essay in Aid of a Grammar of Assent" (1870), and "Letter to the Duke of Norfolk" (1875).

NEW ORLEANS



MAIN STREET OF NEW ORLEANS

This photograph shows Canal Street, the chief shopping centre of the city. It runs north and south, and divides the city into two parts: the old, or French, portion on the east, and the modern portion on the west. The great width of the street can be judged by the fact that even with four tramway tracks in the centre it has ample room for motor cars.

and Spanish) population, who cling to the customs and speech of their ancestors. Modern New Orleans, on the other hand, is a typical American metropolis, making anything and everything, and busy consolidating its position as the greatest cotton market of America. The public and commercial buildings of the city are particularly fine. Along the Mississippi the erection of several embankments or levees has been necessary, for

NEW SOUTH WALES

the land in the delta is very marshy. Another curious result of this marshiness is that ordinary cemeteries cannot be used, and coffins are therefore stored in tiers in arched vaults.

A famous feature of New Orleans is the Mardi Gras (Shrove Tuesday) carnival. It is also worth noting that it was in the negro quarter of the city that jazz music was developed in the first years of this century. The population today is 458,000.

New Orleans, as its name suggests, was founded by French settlers, but in 1763 it was ceded to Spain—hence its Spanish characteristics. In 1802 it was

handed over to France and thence to the U.S.A. **New South Wales, AUSTRALIA.** The oldest and most populous British colony in Australia is now the leading State of the Australian Commonwealth. A large part of the land is devoted to sheep-raising and wheat growing. Wheat is the chief crop grown, and wool is the chief export. Gold abounds in all parts of the state, and silver, copper, tin, lead, iron, wolfram



WINTER SPORTS IN NEW SOUTH WALES

Australia is not usually associated with cold weather, for though most of the Continent experiences ground frosts at night, the average temperature in winter is about that of an English spring. In New South Wales the winter temperature averages between 53° and 46° Fahrenheit, but in the extreme south the Murrumbidgee Range, a group of the Australian Alps, is snow clad, and here the people of New South Wales can enjoy winter sports. This photograph was taken from Mount Kosciuszko (7,328 ft.), the highest peak in Australia.

Courtesy of Director of Australian Trade Publicity

NEW SOUTH WALES

and zinc are also mined. The greatest mineral wealth is found in the coal-fields, which yield many millions of tons of excellent fuel annually.

One-fourth of the State is covered with forests, and timber is an important export. New South Wales, on account of its harbours and resources, has the largest trade of any of the Australian States. Higher education is furnished by the University of Sydney, which is attended by more than 3,000 students. The chief towns are Sydney, the capital (97), Newcastle, and Broken Hill. Canberra, the Federal capital, lies geographically, though not politically, within New South Wales.

New South Wales shares the characteristic formation of eastern Australia—that of a narrow coastal plain, backed by the Great Dividing Range of mountains about a hundred miles inland. This is a favourite holiday region and includes the highest peak in Australia, Mt Kosciuszko (7,328 feet)—the Mecca of winter sports enthusiasts. Opposite Sydney are the Blue Mountains, a region of great scenic beauty. Here are the famous Jenolan caverns.

Other holiday-makers prefer to sun-bathe or surf-ride along the Pacific coast. The rapidly

Area—309,000 square miles (excluding Federal Capital Territory) Population, 2,270,000 (excluding aborigines)
Physical Features—Dividing Range including Blue Mts and a region of high table-lands coastal lowlands, and western plains extending over two-thirds of the State
Rivers include the Murray, Darling and Murrumbidgee
Principal Products—Wheat sugar wool oranges and other fruit dairy products, coal, lead and gold
Chief Cities—Sydney (capital 1,279,000) Newcastle (208,000)

NEWSPAPERS

changing levels give the State a great diversity of climate, from Sydney's mean temperature of 63° at the sea-coast to inland temperatures ranging as high as 130°. Rainfall varies from 64 inches a year

to as low as 10 inches in the west.

New South Wales was discovered by Capt Cook (97) on April 20, 1770. Eighteen years later Capt Arthur Phillip landed 750 convicts at the same spot, Botany Bay, but the settlement was transferred to Port Jackson, near the present site of Sydney. In the first decade of the 19th century New South Wales was transformed from a penal settlement into a colony. Under Governor Macquarie the country was opened up for the first time, and development was henceforth rapid.

The term New South Wales was originally applied to the whole of the mainland of Australia and also to the islands in the south Pacific, but by 1840 it comprised only the three eastern States of today, and twenty years later both Victoria and Queensland had become separate colonies. The executive authority in New South Wales today is vested in a Governor (appointed by the King), assisted by a Council.

How NEWS comes to the BREAKFAST-TABLE

The production and distribution of the newspaper is a daily miracle at which no one thinks to marvel. But when one learns of the difficulties attending it, one can only stand amazed at its performance.

Newspapers. There are few things which we take more for granted than our newspapers. Every morning we come down to breakfast, and



there on the table lies our morning paper. If it did not arrive, it would be assumed that the newsagent had forgotten to deliver it—never that the newspaper staff had failed to turn in sufficient "copy," or that the printing machines had failed to turn out their multitudes of copies recording the happenings of the previous day.

And yet the production of a newspaper is one of the most complicated affairs in the world, requiring an immense staff of men and women, each possessing a highly specialized knowledge. Let us then take a tour through a modern newspaper office.

For our purpose we will choose the London "Daily Sketch," which records the events of the world, not only in print, but by the aid of dozens of pictures of universal interest.

One of the first men to arrive is the news editor. He has in front of him a diary of events that are due to take place that day, and as he glances through it he decides which are of sufficient news value to be reported on. At the same time the art editor, who deals with pictures, is looking through his diary, making notes of events important enough to require photographs to be taken. Then they both go up to the office of the editor in chief, who is responsible for the whole policy of the paper, for the "editorial conference."

This is usually attended by other members of the staff, and its object is to submit ideas for news stories to the editor and to arrange that representatives of the paper shall be present at events which it is known are to take place that day, so that they may record them.

The news editor, for instance, will report that a fashionable wedding is to take place in the

afternoon The art editor finds that he has got this on his list, too, and it is decided to send a reporter to obtain a description of the ceremony and with him a photographer to take pictures of the bride and bridegroom and of such important people as may be present

Before very long a number of reporters and photographers are on their way to the various events One may be interviewing a prominent politician, obtaining his views on the latest Parliamentary Bill Another is seated in the Press box of a football ground, describing the

From now on everybody in the office seems in a feverish hurry Telephone bells ring continuously as one reporter after another tells his story With the receiver clamped to his ear a man takes it down in shorthand and then dashes it off on a typewriter Three or four lines are all that go on a sheet of paper, each of which, as it is finished, is taken by a copy-boy to the sub-editors' room

Here, at a long table, sit the men who check the facts and add to or cut down the copy so that it shall fit the space on the page it is

intended for Titles to the stories are written, and they are hurried along to the composing room, where they are given to linotype operators Almost as fast as the words come from the typewriter the linotype machines set them up in solid type (See Linotype)

Not by any means all the news comes from the newspaper's own reporters Amidst the din, the ringing of bells and the rattling of typewriters, will be heard the clicking of tape-machines Various news-gathering agencies supply the information that appears, letter by letter, on the thin paper ribbon

In every part of the world are the reporters of these agencies, and they call to their aid telephone, telegraph, and wireless telegraph Thus a speech by the President of the United States in Washington appears word for word on the wonderful tape-machines in scores of newspaper offices within a very few minutes of its being spoken The result of a football match in Scotland is known in London before the crowd has left the ground, and the evening

papers insert it immediately in their space reserved for "stop press" news

In the meantime, the art editor is busy with his pictures, selecting the most interesting with expert eye He has to "lay out" his pages so that each picture fits exactly and the final result is pleasing to the eye

When a photograph has been chosen, it may have to be enlarged or reduced in size in order to fit into the place allotted to it It may have to be reversed, too, and it will probably want retouching After being "squared up"—the portion of the print which is to be used marked, as also the size to which it is to be enlarged or



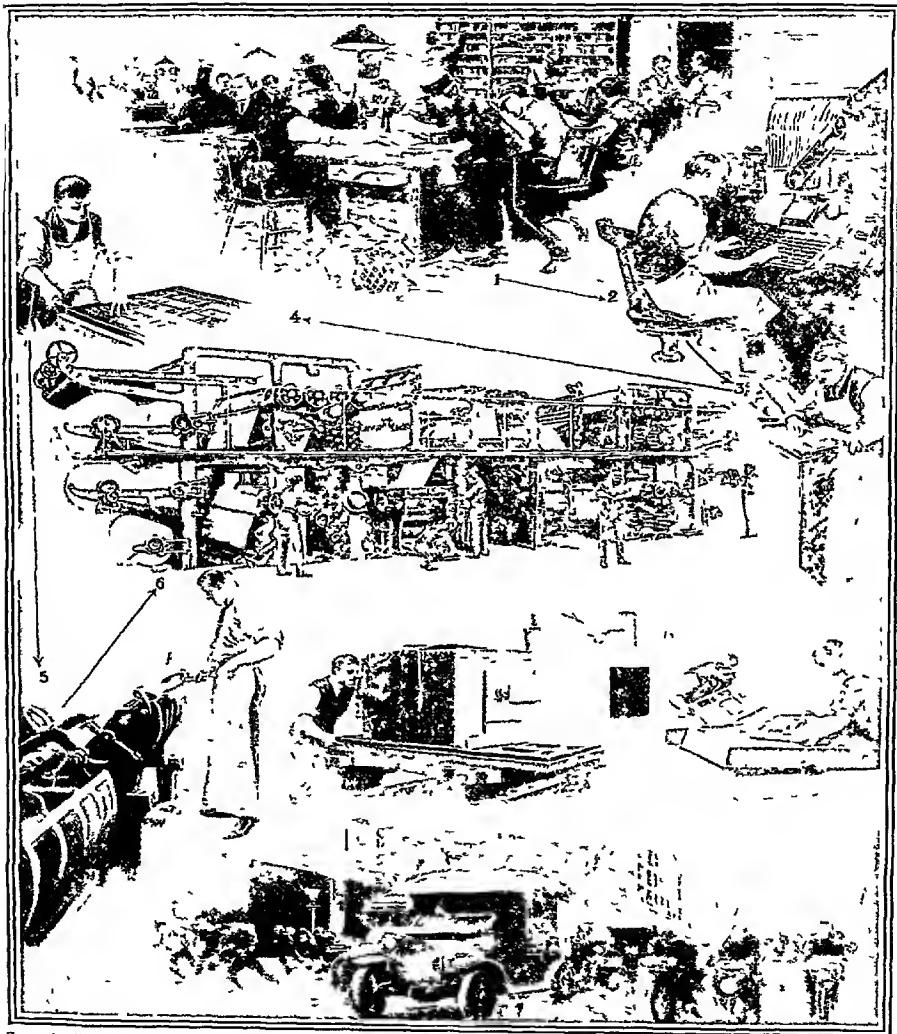
RECEIVING THE FIRST NEWS

An important part in every newspaper office is played by the tape machines, operated by the news agencies, which print the latest news on strips of paper Tape machines are installed also in many big business houses, in clubs and even in some cinemas In front of the tape machine in this picture is a teleprinter, which types out the news

thrills of a cup-tie as they happen A third is at a railway station, awaiting the arrival of a new ambassador from some far-off country, while a fourth is in the Old Bailey taking down word for word the summing-up of a learned judge in a famous trial

Other reporters are still in the office, standing by in case anything happens The telephone bell peals out "Hallo! Yes Right!" The receiver is replaced and a reporter is given his instructions "A big fire in a celluloid factory in the south of London Get the story—quick!" and in a flash the reporter is out of the office and speeding in a taxi to the scene

HOW WE GET OUR DAILY NEWS ABOUT THE WORLD



From the Editorial Room (1), where the stories are prepared the copy goes to the Linotype Machines (2) to be set in type. When the type and headlines are assembled (3) they are made up in page forms (4). Papier-mâché "mats" or moulds taken from the formes are sent to the Stereotyping Room (5) where metal plates are cast. As soon as all the plates have been put in place the great presses (6) are started and papers begin pouring out, to be rushed to all parts of the city by motors, motor cycles, and rickshaws. The other pictures show illustrations "blocks" being made in the Photo engraving Department.

reduced—it passes to an expert artist, who, with a few deft touches “lines” the figures so that they may stand out more prominently. From him the print is hurried to the engravers in order that a block, or cut, may be made from it. (See Engraving)

And now let us go and watch one of the most interesting things in the world—a newspaper going to press. The first edition has to be ready in a few minutes, for it has to catch a train which will take it to the north of Scotland in time to be delivered at the breakfast table the following morning.

By the “stone”—a large flat table—stands a man in his shirt sleeves. He is the “make-up” man. In front of him lies the “chase”—a metal frame the size of a page.

From the compositors comes the metal type, which, after having a rough proof taken from it, is passed to the make-up man. Into the chase it goes—headline, text, picture block and wording—until the page, or form as it is called, is full and fits exactly. He is just about to lock up the forme when the telephone bell rings. Can he hold up the page for a few minutes? One of the reporters has got a “scoop”—a story which no other paper has got—and the editor wants it to be in the first edition at all costs.

A Last Minute Hold-Up

The make-up man glances anxiously at the clock, and looks over his page. Along comes the “scoop,” three or four lines of which have been given to different compositors in order that the whole shall be done as quickly as possible. Something has to come out of the page to make room for the new matter. It is only the work of a second for the make-up man to decide what is to be cancelled or transferred to another page.

Hurriedly the form is locked up and speeded on a truck to a table, where a sheet of papier-mâché is pressed on to the page of type so that it takes the impression of every letter. These moulds pass to the stereotyping room, and are put into the “casting-box,” and within three minutes metal plates are cast from them. They reproduce the original form of type exactly, but with one difference—the plates are curved instead of flat, so that they may fit the rotary presses on which the newspaper is printed.

Now we shall see the last and, from the mechanical point of view, the most wonderful part of the whole process. We follow the curved plates down to the press-room and watch them being placed on the cylinders of a very delicate and complicated piece of machinery.

At one end is a mighty roll of white paper, five miles in length. A signal is given, and at lightning speed the paper is fed into the press. Operation after operation goes on faster than the eye can follow—printing, cutting, folding—till at the other end of the machine we see

rushing out 1,000 complete copies a minute, separated into quires of 26.

Endless belts send them to yet another room, where they are packed up into bundles and hurried to the waiting motor-van, which takes them to the station just in time to catch the train. And then the whole process starts all over again, for another edition has to get to press within forty minutes.

Other Newspaper Departments

Such is the life on a daily newspaper. Yet there are whole hosts of other people connected with it of whom no mention has been made. There is the advertisement manager, with his staff—and very important to the paper he is, for the majority of newspapers are only able to bear the tremendous expense of production by the revenue which comes from advertisements.

There are various editors—the literary editor, the sporting editor, the City editor, the editors of the women's and children's pages—who have each a portion of the paper for which they are responsible. There is the printing manager, who looks after everything and everybody connected with the printing of the paper, and there is the publisher, who concerns himself with the distribution and sales. Then there are specialist journalists writing the “features,” the book reviews, the topical articles, the dramatic and film criticisms, and so on, and clever artists drawing their daily “come stamp.” Each is a cog necessary to keep the mighty mechanism running smoothly.

Just as there are many kinds of news, so there are many kinds of newspapers. There is the “Financial Times,” a daily newspaper for business men dealing exclusively with the intricacies of finance, and keeping its finger on the pulse of the Stock Exchange. There are newspapers devoted to sport. There are weekly newspapers, such as the “Sunday Times” which review the more important of the week's events, in addition to giving the latest information on the happenings of the workaday world in every department of activity.

History of the Daily Paper

Nearly all the great studies in newspaper-making have come in the last hundred years. It was not such a fair cry from the “Acta Diurna” (Daily Events) of ancient Rome—short bulletins of battles, fires, elections, etc., compiled by government officials and posted up in public places—to the official “Notizie Sanite” which the government of Venice issued in the 16th century. This was a hand-written bulletin, and the written journal persisted long after the use of printing began, largely because government censors kept a close watch on printed newspapers. About the same time private presses in other cities of Europe began issuing newsletters from time to time reporting the most



Fox Photos

MORNING PAPERS LEAVING PADDINGTON FOR PENZANCE

At 12 50 a.m. every night the "newspaper special" slides out of Paddington bound for Plymouth (first stop) and all stations beyond to Penzance, carrying to the people of Devon and Cornwall their morning papers, with the news of the world's doings of the day before. Readers in London and the Home Counties receive a later edition. This photograph shows the bundles of newspapers being loaded on to the West of England newspaper train at the Paddington terminus of the Great Western Railway.

remarkable events of the time. In 1616 the newsletter developed into the first regular weekly newspaper, the German "Frankfurter Journal". The first regular newspaper in England was the "Weekly News," started in London in 1622. The freedom of the press from censorship before printing came first in England in 1695.

The big national "dailies," evening papers, and Sunday papers, nearly all of them published in or near Fleet Street in London, are now grouped as follows: the Berry groups, consisting of the "Daily Telegraph and Morning Post" (the "Morning Post" had an independent existence from 1772 to 1937), "Sunday Times," "Daily Sketch," and "Sunday Graphic" (the last two are "picture" papers), "The Times," founded in 1785 as the "Daily Universal Register," and long famed the world over for its sober and unsensational style and for the ripe wisdom of its leading articles, the group founded by Lord Northcliffe (*qv*), including the "Daily Mail"—first creation of the "new" popular journalism—"Evening News," "Sunday Dispatch," and two picture papers, the "Daily Mirror" and "Sunday Pictorial", the Beaverbrook group, owning the "Daily Express," "Evening Standard," and "Sunday Express", the group consisting of the Liberal "News Chronicle" and "Star" (evening),

and Odhams, controlling the "Daily Herald" (the official Labour paper) and the "People," published on Sundays. The "Observer," "News of the World," "Reynolds's," and "Sunday Referee" are all weeklies. The most important of provincial newspapers include the "Manchester Guardian" and the "Yorkshire Post".

Most of the London "national" papers have enormous circulations, the "Daily Express," for example, having a daily sale near the two-and-half million mark—and this despite the modern rivalry of broadcast news bulletins and news reels in the cinemas. The attempt to attain to ever-higher circulation figures is based on the fact that the bigger the circulation the higher the rates that may be charged for advertising space (perhaps it need hardly be said that newspapers as they are at present could not exist without their advertising revenue). But the more astute advertisers are gradually getting to believe that much of the great circulation is inflated, i.e. many people take two dailies, one perhaps only for the free insurance coupon and the other for its news. Hence they stand out against an increase in rates, or transfer their advertising to papers which rely principally upon their news value to achieve their circulation.

The efforts of innumerable men and women working at high pressure in every corner of the

globe—many of them sent out as foreign or special correspondents to report at first-hand events of importance and interest to those at home—combine to give us our daily newspaper. For a penny or twopence each day we glean intelligence of what is taking place in every civilized land. And yet, as we glance over its pages at breakfast, we often remark "Nothing in the paper today," little realizing the romance that lies behind its production.

The Value of Newspaper-Reading

Teachers of history and sociology emphasize the value of the regular reading of newspapers by students. They point out the importance of current news articles as helps in the study of the social, economic, and political trends of the day. Controversy has arisen regarding the good or the harm that is done by the printing of so-called "sensational" news stories, especially those that give details of crime. Editors differ widely in the extent to which they present crime news and in the way they handle such material. Some students of society hold that crime news should be almost entirely omitted, believing such publicity tends to increase crime. Most editors believe that it should receive adequate attention, so that the public may be stirred against it.

Scarcely less remarkable than the development of the newspaper has been that of the

weekly or monthly magazine. The name magazine was first used in connection with the "Gentleman's Magazine," published monthly, beginning in 1731, and described as "a monthly collection to treasure up as in a magazine articles on the subjects with which it proposes to deal." From this beginning magazines have developed and specialized, until now we have not only "general interest" and fiction magazines, but trade journals, magazines for boys and girls, and so on, each variety so specialized as to constitute almost a separate profession for writers and editors. A recent development is the production of handy pocket-size magazines, presenting their material in "tabloid" form.

The enormous task of printing magazines with circulations running into the millions would not be possible were it not for the invention of the electrotyping process, by which several exact duplicates of the plates can be made, so that the magazine can be printed on several presses at once. Huge binding and stitching machines turn out the completed magazines at an almost incredible speed. But with all these wonderful mechanical devices, none of the large periodicals could be made from cover to cover in the short time intervening between issues. The great bulk of the contents is in type weeks and months before the date of the issue in which it is to appear. (See also Journalism)

The MAN who EXPLAINED the UNIVERSE

One of the world's greatest scientific discoverers—yet he wrote just before he died "I seem to have been only a boy playing on the seashore and diverting myself in now and then finding a smoother pebble or prettier shell than ordinary, whilst the Great Ocean of Truth lay all undiscovered before me."

Newton, SIR ISAAC (1642-1727) "Nature and Nature's laws lay hid in night" for ages, but light slowly broke

in the 17th century. Last of a great line of forerunners of the dawn, Galileo died in January, 1642. That same year saw the birth of one greater than he, destined to shed the full light of day on the work of his predecessors—Isaac Newton, who was born on December 25 (old style), 1642, in the village of Woolsthorpe, Lincolnshire.

To compare the 17th century with the 20th is like comparing a stage-coach with an aeroplane, or a wax candle with an electric light. In ideas the two centuries are even farther apart than in inventions, and the

difference is largely due to the sudden flood of light poured on the order of the world by Newton. To realize what his discoveries mean to us, therefore, we must try to look a little way into the minds of men of two or three centuries ago.

Freeing the Inquiring Mind

In the first place, the iron clutch of *authority* on beliefs was only gradually being hammered loose by observation and experiment. "Authority"—do you know what that means? It means that when one asked a question about anything in the universe, one was answered, not by "Watch and find out," or "Try it and see," but "Here is what Aristotle, or St. Augustine, or some other writer dead a thousand years says about it." Only a few bold souls realized that the one great "authority" on Nature is Nature herself, and these men had dared to put their questions to that greatest of teachers in the form of experiments.

Again, the bare idea of *invariable natural law* was as yet vague and unformed. Of course, men had always recognized a certain order underneath



Science Museum
Newton's Original Telescope

Nature's apparent confusion The sun always rises in the east and sets in the west, summer and winter, day and night, always follow each other, heavy objects dropped in mid air always fall to the ground But to most people, amid all the seeming uncalculable waywardness of wind and weather and life and death, this seemed merely like the queer streak of reasonableness one sometimes finds in otherwise capri

Such was the intellectual world into which Newton was born He was the son of a gentle man farmer, who, dying before his only son's birth, left his widow in very moderate circumstances At school young Isaac, according to his own later accounts, was rather an idler The classical Greek and Latin education of the times must, indeed, have been deadly dull to a mind like his, all alive with curiosity about the nature of the universe Not being able to find out what he wanted to know in school, the boy made now a wind mill, now a water clock, and now a carriage to be propelled by the occupant—as well as sundials, and even doll's furniture for little girl friends

One science, to be sure—mathematics—did form a part of "every gentleman's education," and in this Newton was a discoverer almost as soon as he was a graduate He developed the new method of calculus (or, as he called it, "fluxions") in the year in which he graduated at Trinity College, Cambridge—in 1665 The method is of great importance, not only in itself, but as a means later used in proving the theory of gravitation, the germ of which seems to have lodged in Newton's mind about the same time

The "apple story" is told elsewhere (See page 1935) The calculations of the moon's orbit, which Newton made then to test the gravitation theory, agreed "pretty nearly" with the known facts, but "to a mind like Newton's 'pretty nearly' is as bad as 'not at all,'" and so gravitation was laid aside for the time being

Now began the series of careful, logically conducted experiments on light and colour, which were to lead to the first of his great discoveries in natural science By 1669, the year in which he was appointed professor of mathematics at Cambridge University, Newton had demonstrated the compound character of light, and the fact that colour resides not in the object but in the light itself These discoveries were not made public, however, until 1672, when Newton reported them to the Royal Society His studies of light also led him to the invention of the reflecting telescope

Newton explained light by the "corpuscular" theory—that is, that it was a stream of minute particles or "corpuscles" given off at a high velocity by a luminous body Scientists later adopted the wave theory (See Light) But since then the discovery of radium and the manifestations of radioactivity have proved the existence of minute particles moving with the high speeds



SIR ISAAC NEWTON

Sir Isaac Newton was a brilliant genius and, like most geniuses, lived a very simple life even after his incomparable gifts of intellect had won him high honour and place This portrait by John Vanderbank shows the distinguished scientist at work among his books and simple apparatus
National Portrait Gallery

cious persons—a riddle without an answer Great minds from Heraclitus to Kepler, indeed, had dreamed of harmonizing the facts of Nature by some underlying universal law, but their attempts were mainly wild guesses, for lack of the exact knowledge furnished by observation and experiment

The wonderland of science was at hand in the commonest everyday things, but its truths could not be understood except in the light of natural law What passed for natural science in most people's minds before Newton's time was a mere hash of childish curiosities and far fetched fables What we nowadays call the "natural sciences" had no place in a "liberal education" at that time, for the very good reason that as yet they scarcely existed The nature of light, of heat, of sound, and of electricity were unknown, chemistry was still befogged with alchemy, and astronomy with astrology Scientific instruments were still crude and unreliable



NEWTON'S PRISM

Isaac Newton's greatest achievement in optics was the analysis of white light into the primary colours. The prism above, presented by a descendant of Newton to the British Museum, is the one he used in his optical studies.

British Museum

needed for Newton's corpuscular theory, and now we are not so sure that Newton was wholly wrong on this point. (See Atom, Radium)

Just when Newton resumed his study of the problem of gravitation is not known, but in 1684 the astronomer Edmund Halley stumbled upon the fact that the quiet Cambridge scholar had worked out in solitude the principles of the theory. At Halley's request Newton set them forth in the great work generally called the "Principia" (*Philosophiæ Naturalis Principia Mathematica*, or *Mathematical Principles of Natural Philosophy*), the most important single contribution to science ever made by any one man. It established the ideas of "mass" and "force," the principles of the mechanics of the heavenly bodies, and the science of theoretical mechanics as it exists today.

Newton shrank from publicity to a degree almost unknown today. He kept secret for a time many of his greatest discoveries, for fear of the notoriety they might bring him. When he communicated to "Philosophical Transactions" his solution of the moon's rotation round the

earth, he forbade the publication of his name. "It would, perhaps, increase my acquaintance—the thing which I chiefly study to decline." Controversy was distasteful to him, and the dispute with the German scientist G. W. Leibniz over the calculus (which the two men seem to have invented independently) was the exception to a rule liberally adopted and closely kept. But when James II interfered illegally with the universities, Newton took an active part in defending the University of Cambridge. Later, he was elected to a seat in the Convention Parliament which seated William and Mary on the throne in place of James II. His friend Charles Montague, Chancellor of the Exchequer, then appointed him to a position in the Mint in 1696, and in 1699 he was made its head.

Now we may see our philosopher enjoying a modest yet ample fortune—"three lackeys" to his coach and as many servants indoors. A charming and devoted niece kept his establishment running smoothly, and his income permitted him to dispense his bounty generously to needy men of science and members of his own family. In 1703 he was elected president of the Royal Society, "the highest honour in science to which an Englishman could aspire." Knight-hood at the hand of good Queen Anne followed in 1705. So peace and prosperity were Newton's lot until his death, March 20, 1727. His bones lie today among the great in Westminster Abbey.

New Year's Day. When the first day of the New Year is celebrated, a custom is followed that dates back to the very dawn of civilization, for nearly all peoples have observed a

New Year celebration, though the time has varied widely—sometimes as early as the autumnal equinox (about September 21), and sometimes as late as Midsummer Day (June 24). If we could travel round the world on a magic carpet and peep at the New Year celebrations in the various countries, what a wonderful variety of customs we should find! If you were in China you might think that the Chinese were celebrating all their holidays for the year at once, for they close their shops for several days while they make merry with feasts and fireworks and the general exchange of gifts and good wishes. In preparation, every debt must have been paid,



DANCING THE NEW YEAR IN

Dancing has always, in every land, been one of the chief means of expressing jubilation, and so we find that people all over the world herald the arrival of the New Year with balls and similar festivities. Above we see a merry throng dancing in the Albert Hall, London, on the occasion of the Chelsea Arts Ball on New Year's Eve, 1937-8.

every house swept and cleaned, and each person furnished with holiday clothes and a supply of preserved fruits, sweets, and ornamental packages of tea to give to his acquaintances.

The Japanese New Year festival is perhaps even gayer. No matter how poor he may be, everyone provides himself with new clothes and takes three days off from work to visit his friends or entertain them at his home. Every gate post is adorned with dark green pines and feathery, light-green bamboos, while over the doorways hang vivid red lobsters and crabs, and scarlet, tangerine like fruits, symbolical of long life and happiness, the streets are thronged with happy children playing battledore and shuttlecock.

Where New Year Means Presents

Throughout the rest of the Orient, too, the opening of the New Year is celebrated with elaborate festivals that correspond to the Christmas celebrations of western countries. In some European countries, especially France and Scotland, New Year's Day is almost more important a holiday than Christmas. If you were a French peasant child you might put your *sabot* (wooden shoe) on the hearth for a gift at Christmas, but grown-ups in France exchange gifts at the New Year festival, at which time there are also family parties.

Scotland celebrates New Year's Eve with a heartiness nowhere surpassed. The old time tradition that to be "first foot" in a house brings luck for the whole year, sends throngs

of midnight revellers into the streets of Scottish cities on New Year's Eve, each with his box of cakes and his whisky bottle, for in order to ensure his host a bounteous year he must not enter empty-handed.

Some cities have their special local customs. Formerly in Leningrad (Russia) the New Year was ushered in by a cannonade of one hundred shots fired at midnight. In some Scandinavian cities, also, the New Year is welcomed with a noise of firearms, while the Yuletide celebration continues until Twelfth Night (12 days after Christmas), as in Italy.

In America the observance of New Year's Day is as varied as the character of the people that make up the New World. In England each city and district has its New Year's "watch night" service in the churches, its dancing and theatre parties, its gay street revellers, and New Year's Day is a time for general entertaining and visiting.

March 23 was the usual date for beginning the new year in most Christian countries in the Middle Ages, and England retained this date until 1752. In those countries which still use the Julian calendar New Year now comes on January 13 of our reckoning (see Calendar). The Jewish New Year, which opens with Tishri, our September, is called the "Feast of the Trumpets," and lasts for forty-eight hours. The Chinese New Year now coincides with that of the western world.

GIANT CITY of the NEW WORLD

We have been made familiar with many of the sights and sounds of New York by the films. The short tour taken in these pages will show us still more of this "modern Babylon".

New York CITY AND STATE In size, in wealth, in financial operations, in manufacturing, in foreign commerce, and in its motley



Statue of Liberty, New York

racial elements, New York is one of the two greatest cities of the world. Its population of about 7,000,000 exceeds that of Sweden, Norway, and many another nation, and is exceeded by that of London only among the world's great cities.

It is the most important manufacturing and business centre of the United States, and is one of the leading financial centres of the globe. It is a very rich city, with luxurious dwellings and hotels, yet a walk of ten minutes

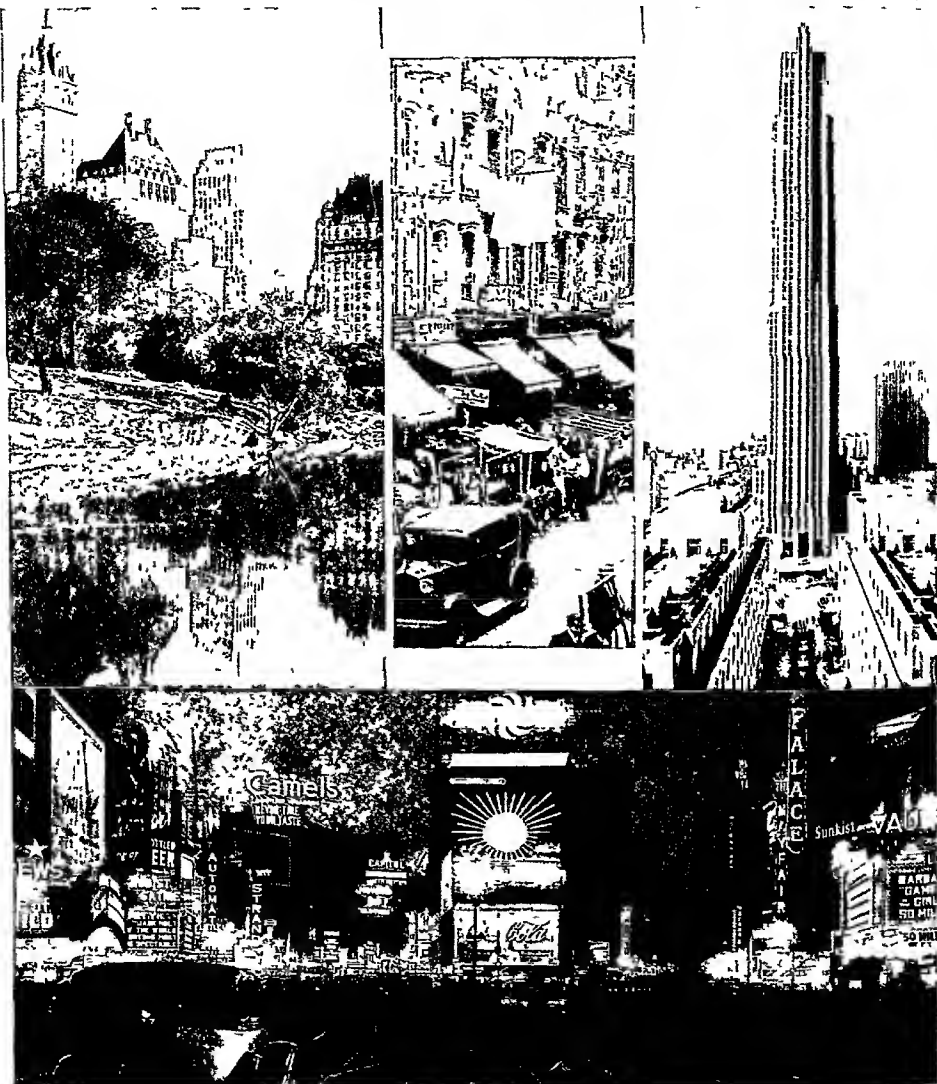
from its financial and shopping centres will take you to haunts of the extreme poverty and misery on East Side.

In the middle of the Upper Bay of New York, which lies south of the city, is Bedloe's or Liberty Island. On this stands Bartholdi's far famed statue of "Liberty Enlightening the World," given by the people of France to the United States in 1886.

Looking north east, you see the tip of the tongue shaped island of Manhattan, the heart of New York, crowded with tall sky-scrapers. On each side of Manhattan are wide rivers swarming with ships, ferry-boats, and launches. The river that skirts it on the west is Hudson River, still called in its lower course "North River," by New Yorkers to distinguish it from the Delaware, the "South River" of old colonial days. On its western shore lies the State of New Jersey.

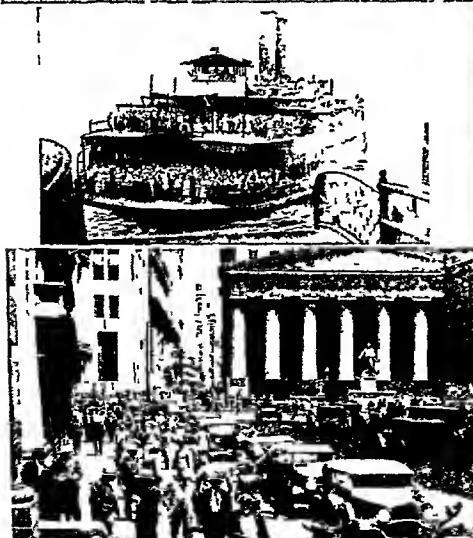
The winding "East River," on the other side of Manhattan, is crossed by several great

A LITTLE TOUR THROUGH THE MANY FASCINATING



New York City's never-ending contrasts are well exemplified by the view showing a bit of Central Park overlooked by a group of luxurious hotels and an office building at 59th Street and Fifth Avenue. Yet a few blocks away we can find dire poverty, as in the East Side scene, with its barrows and washing hung over the street. The tall building in the upper right-hand picture is the dominating feature of Rockefeller Centre. We view it from Fifth Avenue, a great residential and business thoroughfare. In the bottom picture, Broadway at the left and Seventh Avenue at the right run north from Times Square in all their night-time glitter.

SCENES OF NORTH AMERICA'S GREAT METROPOLIS



At the top we look from the northeast across "downtown" and the Hudson River toward New Jersey. In the foreground is Manhattan Bridge, with Brooklyn Bridge beyond. Note the many steamer piers, and observe how the tenements of the lower East Side, although several storeys high, are overshadowed by the approaches to the mighty bridges. In the ferry picture we see the Staten Islanders coming to work, and below we look at the Subtreasury Building in the heart of the Wall Street district. Finally, we get a glimpse of fashionable Park Avenue where it tunnels through an office building and leads to an elevated ramp flanking Grand Central Station.

bridges—the Brooklyn, Manhattan, Williamsburg, Queensborough, and Triborough structures. In East River are three large islands—Welfare, Ward's, and Randall's—that are occupied chiefly by prisons and other municipal institutions of Greater New York. On the other side of East River is Long Island, whose populous boroughs of Brooklyn and Queens are part of New York City.

The Islands of the City

Now look south towards the neck of the pear-shaped bay, the mile-wide channel called the "Narrows," which connects the Upper Bay and the Lower Bay. East of it is Long Island, and on the west are the beautiful wooded slopes of Staten Island (Richmond Borough), a densely populated but still pretty suburb of New York. Between it and Manhattan Island ferries are constantly plying backwards and forwards.

Returning in the ferry from Bedloe's Island to Manhattan, you will pass Ellis Island, used by the Federal government as a landing-place for immigrants under detention. At the entrance to East River you will also get a glimpse of Governor's Island, which is occupied by the government for military purposes, and then in a few minutes you arrive at the "Battery," the southern tip of Manhattan. Battery Park (twenty-one acres) occupies the site of the old Dutch fortifications. The round fort is now an aquarium, containing one of the world's finest collections.

Manhattan Island is only from 1 to 2½ miles wide and 13½ miles long. Until 1874 the city did not extend beyond its limits. A good walker could cross the island in 30 minutes, and he could walk its length, from the Battery up Broadway to the Harlem River, in a few hours, but today more than one-third of New York's total population is crowded in this small space. On the average square mile there are more than 85,000 people.

Why Skyscrapers Are Possible

To accommodate this immense working population, the business quarters have been covered with towering structures, many of which house as many people as a small town. By the invention of the steel skeleton type of construction (see Building Construction) a generation ago, it was made possible to carry these buildings 20, 40, 50, and even 100 storeys into the air, while their enormous weight is sustained on piers sunk to bedrock, sometimes 100 feet below the surface.

The tallest structure ever constructed by Man is the Empire State Building, mammoth of "mid-town" Manhattan. It is 102 storeys high, and rises to 1,250 feet. There are over thirty other skyscrapers in Manhattan more than 500 ft high.

The streets of Manhattan are indeed wonderful. There is Wall Street, the financial centre of the United States, an extremely narrow thoroughfare, hardly half a mile long, it has an importance altogether disproportionate to its size. At the head of Wall Street, in the midst of the banks and great office buildings and just beyond the roar of the kerb market in Broadway, stands Trinity Church with its old graveyard. Half a mile to the north another tiny but famous street runs east from Broadway, the historic Park Row, once the home of several great newspapers.

The shape and "street layout" of Manhattan make it easy for us to make a survey of the island. The present street plan was devised in 1811, to provide orderly growth beyond the "crazy quilt" area of the old town. East-west streets, numbered northward, connected the two rivers, while about a dozen avenues, numbered from First Avenue on the east, ran north and south. This idea in city planning seemed sound at the time, when everyone thought that industry would hug the river banks, and people would move east or west in going to and from work. Actually, the unforeseen and tremendous growth of New York has thrown most of the traffic burden on the few north-and-south avenues.

Famous Streets and Avenues

The most important of these is Broadway itself, which runs north-eastward through the island from the Battery up to the Harlem River and beyond, and changes its character half a dozen times in as many miles. In the lower part of the city it is strangely narrow, but contains some of the most famous buildings in New York. Besides Trinity Church, St Paul's Chapel is in this street, a cherished relic of colonial days. Office buildings in Broadway include the Singer Building and the Woolworth Building, two of the older but still outstanding skyscrapers of New York.

Near the six-cornered crossing of Broadway with Sixth Avenue and Thirty-third Street is one of the busiest sections in the city, with many department stores and famous hotels. Above Forty-second Street, where most of the important theatres are in close proximity, and on which fronts the great needle-spined Chrysler Building, Broadway is known as the "Great White Way," from the thousands of brilliant electric lights of the ingenious advertisements.

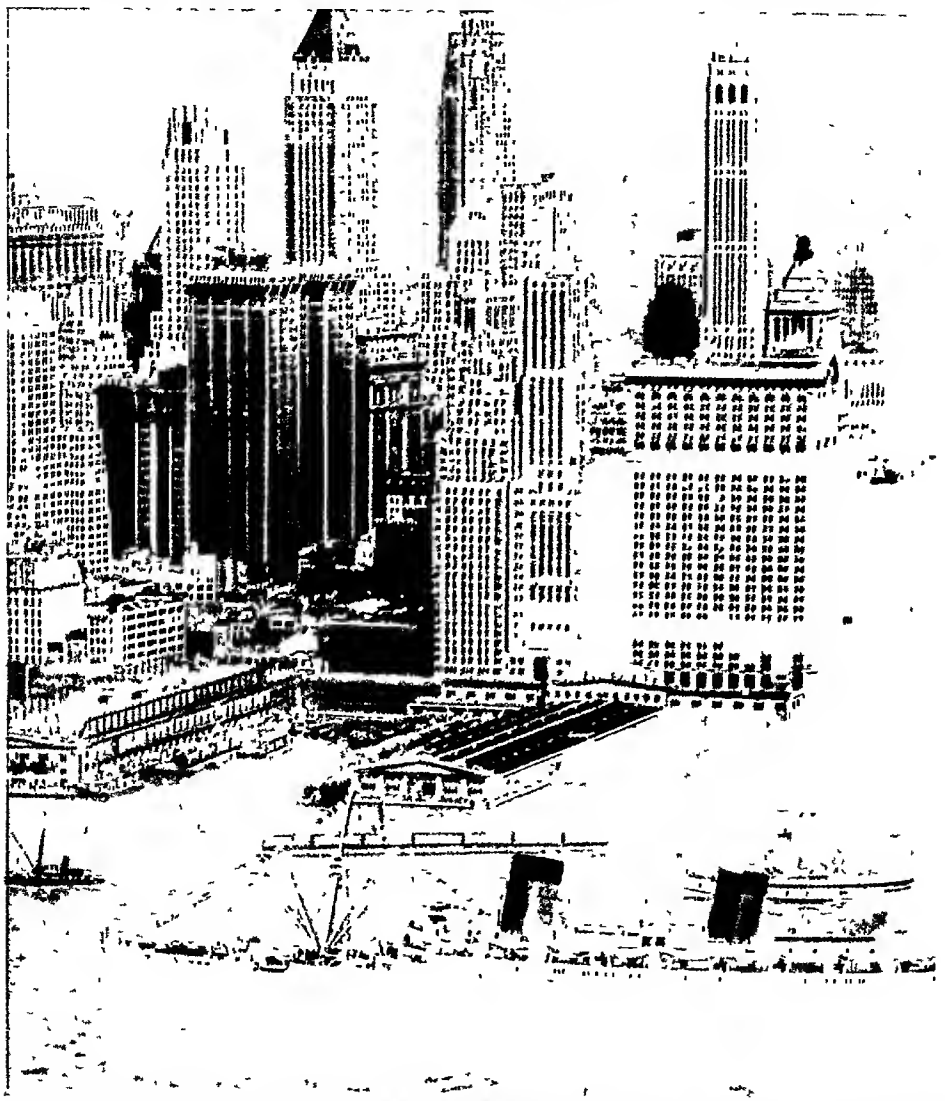
Very different from Broadway, but no less famed, is Fifth Avenue, New York's most beautiful thoroughfare. Beginning with Washington Arch at Washington Square, about a quarter of a mile west of Broadway at this point, it extends north for six miles, lined with fashionable shops, churches, clubs, hotels, and costly residences. Among the notable buildings are the Public Library at Forty-second Street, a palatial structure which houses three and a

IN THE WONDER CITY OF THE WEST



hat a wonderful view of New York is spread before us from the upper windows of one of its great skyscrapers! In this view
 in the City Bank Building, that tall majestic building on the left is the headquarters of the Bank of Manhattan (838 feet) on
 all Street, and the skyscraper of somewhat similar appearance which rises in the distance, on its right, is the Woolworth Building
 2 feet high, situated on Broadway. When we are up as high as this we almost feel that our heads are 'scraping the sky'.

BRITAIN'S PROUDEST STEAMSHIP ARRIVES IN—



How impressive is the first sight of New York as the steamer glides up the Hudson River to her moorings! In this wonder photograph that cluster on Manhattan Island, overlooking the harbour. The four highest buildings in the centre of the photograph are, from left to right, seen Battery Park the southern extremity of Manhattan Island.

-THE HARBOUR OF AMERICA'S MIGHTIEST CITY



Queen Mary is seen arriving on June 1, 1936, after her maiden voyage, but even this great liner is dwarfed by the skyscrapers, right, those of the Irving Trust, Bank of Manhattan, Cities' Service and City Bank Farmers' Trust. On the extreme right can be seen great crowds are gathered to welcome the gigantic ship.

Acrophina Ltd



BRIGHT LIGHTS OF BROADWAY—CENTRE OF NEW YORK'S NIGHT LIFE

Broadway, seen above, is one of New York's most famous streets. It owes its name to the Dutch, who called it the 'breede weg'. Much of its fame is derived from one short section of about a mile in length, in and around which are clustered most of the city's greatest theatres, music-halls, and cinemas. Rather drab and tawdry in the daytime, Broadway is seen at its best after dark when a profusion of illuminated signs gives it a dazzling brilliance.

half million volumes and pamphlets, and, between Fifth and Sixth Avenues from Forty eighth to Fifty-first Streets, the huge Rockefeller Centre. This includes the RCA building, housing 70,000 workers, the International Radio City Music Hall (the largest in the world), and the British Empire Building. The beautiful St. Patrick's Cathedral is on Fifth Avenue near by, at Fifty-first Street, and St. Thomas's Church is at Fifty-third.

Near Washington Square is the quaint old Greenwich Village district—the "Latin Quarter" of New York—which prides itself on its Bohemianism and its art. Like the rest of lower New York, it is a maze of short, crooked streets. The famous Bowery, a curving avenue roughly parallel with Broadway, is one of the chief thoroughfares of the cosmopolitan tenement area of East Side.

The 'Lungs' of the Great City

New York possesses many breathing spaces for its congested population. Directly in the centre of Manhattan is Central Park. In it, on the Fifth Avenue side, is the Metropolitan Museum of Art, the largest and richest art museum in America, and west of the park is the American Museum of Natural History. There are scores of other parks and hundreds of playgrounds. But the greatest crowds go to Coney Island, just south of Long Island and fronting directly on the ocean.

Every country of the world and every state of the nation contributes to the population of New York City. There are many well defined foreign communities in the city, such as "Little Italy," "Chinatown," and Jewish, German, French, Russian, Greek, negro, and Armenian quarters.

It is a huge task to replace the 70 or more tongues of New York's immigrants by English and fit the boys and girls for useful places in the community, and if it were not that New York is so rich it would be hopeless to attempt the task. Immense sums are spent yearly in educating the 1,000,000 pupils who receive instruction in the schools of the city. In addition to the municipally supported College of the City of New York, near the Hudson River, New York has two of the larger universities of the United States—Columbia University with its affiliated colleges, and New York University, in the Bronx, where is the Hall of Fame.

How the Millions Get to Work

New York is still struggling with its transport problem, for every day twice as many people have to be transported in Greater New York as are moved by all the steam railways in the whole United States. On Manhattan itself, in addition to the surface lines, which run on nearly every north- and south avenue, there are four parallel lines of elevated railway

tracks, besides the "subways," the equivalent of London's Tube railways—one line running northward under Broadway, and another under Lexington Avenue on the East Side. Both continue through tunnels under the East River to Brooklyn.

By Bridge, Ferry and Tunnel

Five bridges, already enumerated, cross the East River, towering high above the water's level to permit the passage of ocean steamers, while farther north, over the Hudson River, is the beautiful George Washington suspension bridge. Even this aggregation of immense bridges, however, is unequal to carrying the armies of people who travel daily between Manhattan and Long Island. Several subways, have, therefore, been built under the river while between Manhattan and Jersey City (under the Hudson) run the Holland Tunnel and the Lincoln Tunnel, both for motor vehicles. Swarms of ferry-boats also dart backwards and forwards across the East and Hudson rivers, connecting Manhattan with Brooklyn, Staten Island, Hoboken, and other points.

The commercial supremacy of New York is due to its central situation on the sea-board, and especially to its harbour, one of the largest and best in the world, which lies at the entrance to the fine natural waterway of the Hudson valley. Through this harbour passes almost half the foreign commerce of the United States.

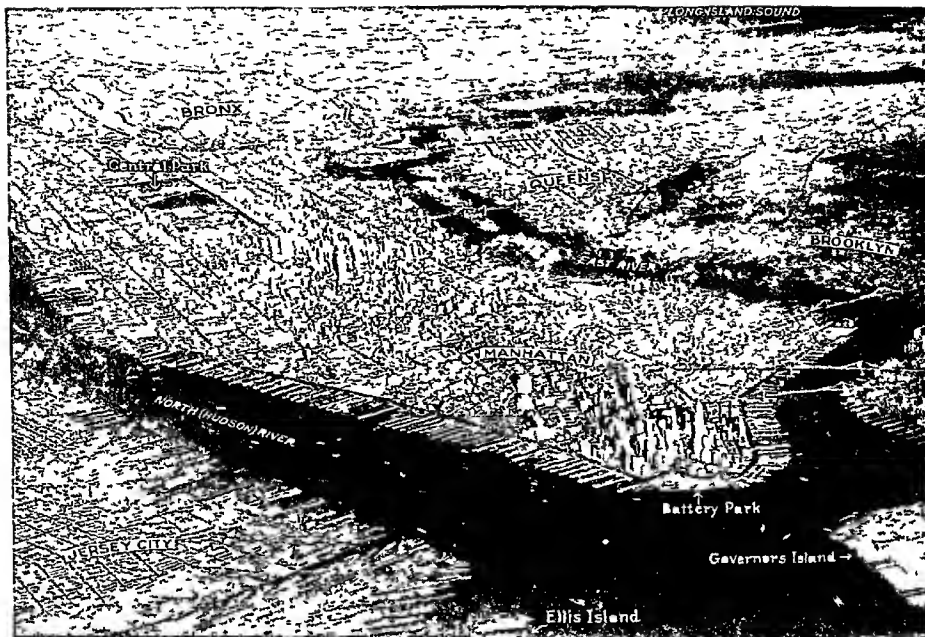
Now York's financial and commercial interests are on so enormous a scale that they overshadow its great manufacturing industries. But nearly ten per cent of the manufactured goods of the United States are produced in New York City.

New York's History in Brief

New York City was prominent in the movement which led to American independence. The city was occupied by the British armies during the whole of this war, and was a chief refuge for loyalists. Before the Revolution New York was outranked by both Boston and Philadelphia in commerce, but after the British evacuation (1783) it forged rapidly to the front. The city was the capital of the colony and state of New York until 1797, and in 1789-90 it was also the Federal capital.

New York State is one of the thirteen original states of the American Union. Its area is 49,204 square miles. Albany is the capital, with a population of 127,000, but larger cities are New York, Buffalo (573,000), Rochester (328,000), and Syracuse (209,000). Other towns include Schenectady, great electrical and broadcasting centre, and West Point, home of the U.S. Naval Academy.

New York State has one of the finest harbours in the world. It also has an inland highway



ABOVE THE SKYSCRAPERS

This aerial photograph shows the principal features of New York's geography, with Manhattan Island in the centre. "Midtown" is south of Central Park.

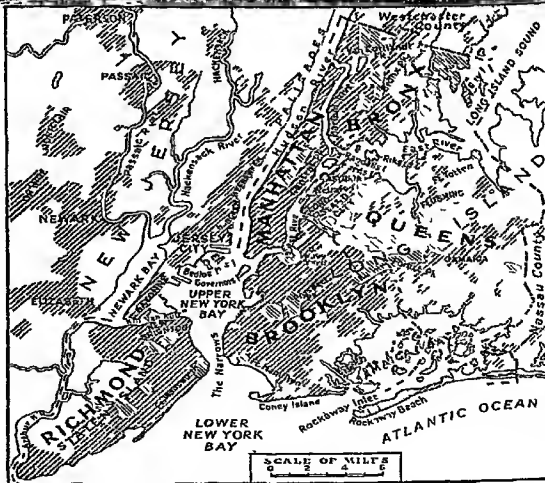
to the west through the Mohawk-Hudson valley, abundance of water-power, and coal-beds near at hand.

Among the rivers are the St. Lawrence (forming the Canadian boundary), the Hudson, the Mohawk and its tributaries, and the Niagara.

Long Island is one of the greatest land possessions of the U.S.A., and the picturesque "Thousand Islands" in the St. Lawrence are favourite summer resorts. The Adirondack and Catskill Mountains are much frequented.

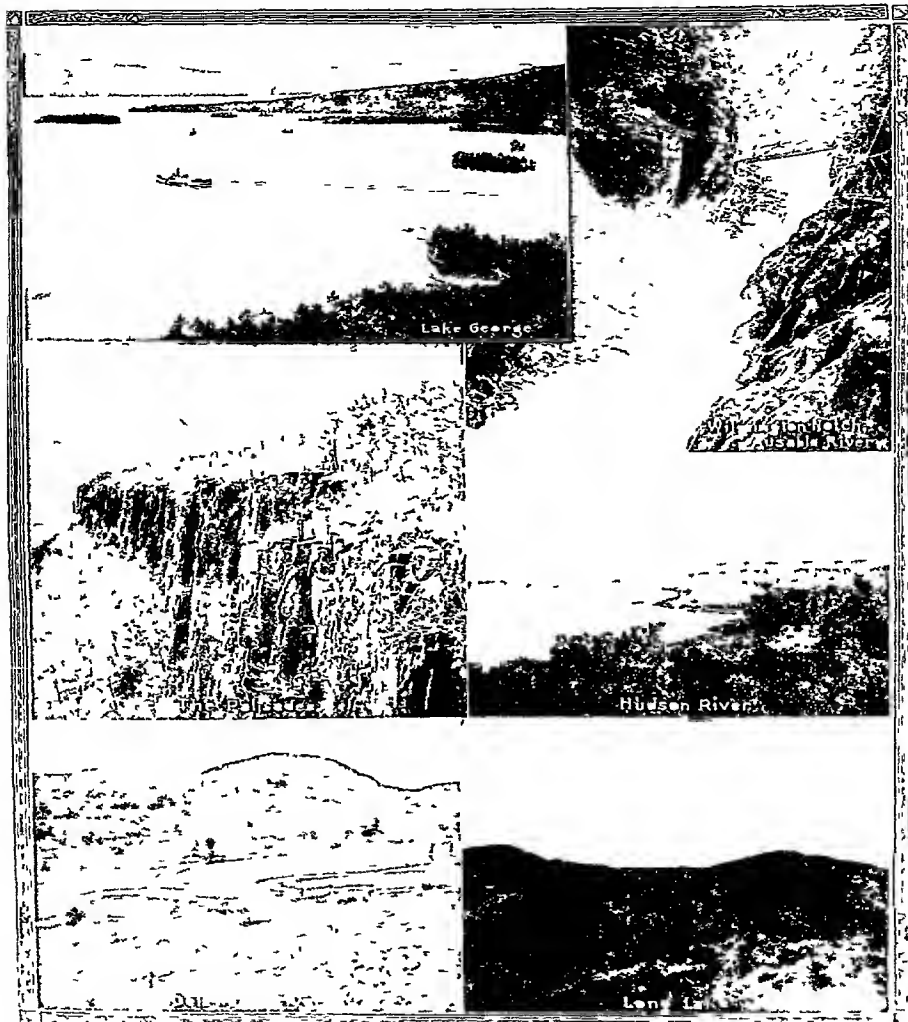
Among important industries are the manufacture of clothing, the publishing of newspapers, periodicals, and books, the making of paper and wood-pulp, electrical machinery, photographic materials, dairy products, foundry and machine-shop products, textiles, and packed and dressed meats.

The first European to enter New York harbour was Giovanni Verrazano, who



In the map above, which shows the same area as is seen in the photograph at the top of the page, heavy shading indicates the densely-populated areas.

A TRIP INTO NEW YORK'S LOVELY COUNTRYSIDE



While the great commonwealth of the Hudson and Mohawk is notable for its wealth and industry it has its charming aspects as well—jewel like lakes, towering cliffs and mountains, majestic rivers and quiet streams wandering through rich valley farms. Lake George in the eastern part of the state, is a well known and attractive holiday region. Wilmington Notch is one of the many lovely spots in the Adirondack Mountains while the Palisades loom above the Hudson within sight of New York City. In summary, some of the upper valleys of the Hudson and the Delaware with their scenes of real beauty. Long Lake, 14 miles long and over a mile wide, is in the Adirondacks.

arrived in 1524 In 1609 the Englishman Henry Hudson explored the Hudson River, and Champlain entered the state from Canada. The first trading-posts, made by the Dutch at Fort Nassau (Albany) and on Manhattan Island, started in 1614. For all Manhattan Island the Dutch in 1626 paid the Indians roughly \$5 in beads, brass ornaments, and bright cloths. In 1664 an English fleet sent by

the Duke of York (afterwards James II) captured New Amsterdam as the chief town of the colony was called by the Dutch, and the name was changed to New York in the duke's honour. But for many years the city retained its Dutch character. New York was the last portion of the Old Thirteen Colonies to be evacuated by the British. The population of New York State is about 12,588,000.

The OTHER BRITAIN of the FAR SOUTH

Almost exactly on the other side of the world from the Mother Country lies Britain's farthest Dominion—a beautiful land of almost tropic heat and snow-clad Alps, and of plentiful wealth as yet untouched

New Zealand. It was a hardy Dutch seafarer, Abel Janszoon Tasman, who found these islands in 1642 and gave the land the name it bears today. But no white man seems to have visited New Zealand from that time until 1769, when Captain James Cook, the famous English navigator, visited the islands and explored the coasts and the dividing strait which bears his name. He also visited them in 1773, 1774, and again in 1777, on his last voyage.

During the next 60 years whaling vessels and trading schooners seeking timber came to New Zealand. The first settlement, by missionaries, was made in 1815. The Maori inhabitants, although they were an intelligent race of people, tall, strong, courageous, and resourceful, were addicted to cannibalism and to intertribal warfare. At various times they turned upon the white settlers with fury, and the bloody conflict did not cease until 1871. The Maoris of today are law-abiding, peaceful, and intelligent, though indolent. Some of them have risen to important governmental positions, while others have distinguished themselves in sport—especially in the "All-Blacks" Rugby teams.

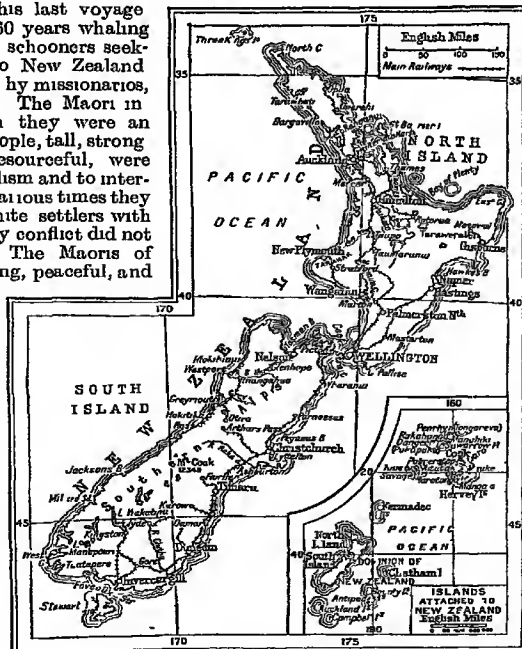
The islands which constitute the Dominion of New Zealand are situated in the South Pacific about 1,200 miles to the south-east of Australia. They are regions of

strange and most beautiful contrasts, though in general the scenery is very English in character. North Island, a moist, semi-tropical region in its upper portion, is filled with amazing geological wonders. Cone-shaped volcanoes rise abruptly from its eastern plains, and around Rotorua is a region of geysers, hot springs, and vast crevices where boiling mud bubbles up from subterranean furnaces. In 1931 a severe earth

quake, involving much loss of life and property, occurred in the Napier district.

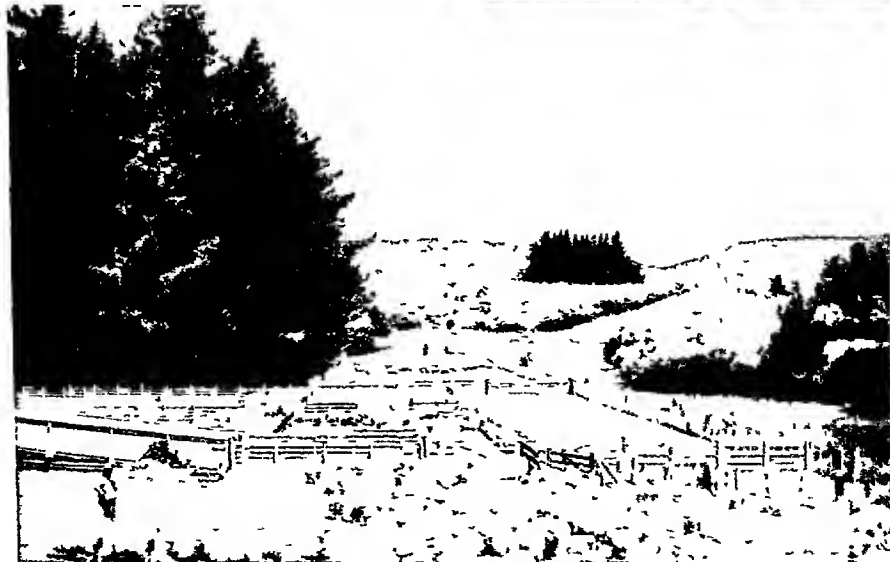
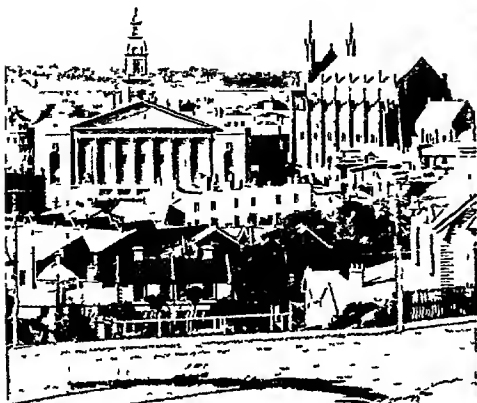
South Island is even more rugged and magnificent. In the south-west the coast is broken by narrow, picturesque fiords, where the sea worms its way far inland between cloud-capped peaks. Stern chains of lofty mountains, the main range of which is appropriately called the Southern Alps, stretch from end to end of the long narrow island. On their western slopes these mountains are covered with forests, on the east with scrub and tussock grass.

New Zealand's trees are its crowning glory. Graceful ferns, 20 or 30 feet high, are abundant, as is the kauri palm.



THE DOMINION OF NEW ZEALAND

CITY AND COUNTRYSIDE VIEWS OF NEW ZEALAND



The photograph top left shows two of the chief buildings in Dunedin, the largest city of South Island, they are the Town Hall (left) and the Cathedral. Luxuriant foliage is characteristic of northern New Zealand and on the right tree ferns are seen growing beside the lake in Pukekura Park, New Plymouth North Island. The lower photograph was taken on a sheep farm lying in pastoral country typical of the eastern half of South Island.

Fig. courtesy of the High Commission for New Zealand



NEW ZEALAND'S ABORIGINES

The Maoris of New Zealand, though they have taken readily to civilization, still retain many of their old ways. Above, a Maori woman is doing her day's washing in the open in the hot springs district. Top right is a Maori child bathing in Nature's bathroom in the same region. On the right is a Maori chief in what was once his war paint, standing beside the totem pole outside his house.

Photos: left Mett Le Toq; right Wide World; bottom Krystone.

The fronds of this remarkable palm shoot up from the trunk at so sharp an angle that the wild parrot has to hang head downwards from the leaves to reach the scarlet fruit. Nearly every tree bears a creeper or a parasite like the deadly rata, which chokes and smothers the life upon which it feeds.

The lordliest tree of the forest is the kauri, rather squat with a trunk often twelve feet thick. Up in the slender neck of North Island the whole countryside has been turned upside down by "gum-diggers," who scrape away the soil seeking the valuable half-fossilized kauri resin, deposited by ancient forests and now used for making varnish and linoleum.



New Zealand's chief industry is sheep-raising, particularly on the Canterbury Plains (qv) in South Island. Wool, skins, and chilled mutton and lamb are the principal exports. Some beef and pork are also shipped to Great Britain, together with butter, cheese, and other dairy products. Agriculture is constantly growing in importance under the influence of the favourable climate. Large areas have been sown with English grasses to serve as pasturage for livestock. Gold mining has been an important industry since 1857, and the islands contain also important deposits of silver, copper, iron, lead, zinc, and antimony. Petroleum and coal

Extent—1,100 miles in length, and 180 miles across at broadest part, area (excluding annexed islands), 103,722 sq miles. Population (excluding aborigines), 1,491,484.

Physical Features—In South Island are the Southern Alps, reaching 12,000 ft in Mt Cook, to the west are the Canterbury Plains. There is also mountainous country in North Island, with many volcanic peaks. Several lakes including Taupo (22 miles long), and many short rivers.

Principal Products—Sheep, wool, butter, cheese, wheat, oats, barley, coal, gold.

Chief Cities—Auckland (214,200), Wellington (capital 151,000), Christchurch (132,000), Dunedin (82,000). Whangarei 25,000.

are produced for local use. Sugar-refining and shipbuilding give employment to many.

Except for the descendants of the domestic animals brought by the Maoris, there were no land mammals in New Zealand when white men landed. Nor are there today any snakes or important poisonous insects. Rabbits were introduced, and in a short time numbered millions and did such damage to vegetation as to threaten stock grazing. But with government aid, after a long fight, this danger was brought under control. The same thing has happened with various insect pests, while the common hramble has spread amazingly in both islands.

Other important introductions to the islands include those of red deer into the mountains, clover as a forage crop, and larch and other conifers for timber.

Among the birds the most notable are the kea or sheep killing parrot, the albatross, and various penguins. The moa, which survived until shortly before the island's discovery, was the largest bird ever to have existed. Twelve feet tall, it was like an enlarged ostrich in appearance. Its eggs have been discovered in caves. Oysters are found in abundance along the coasts, together with a particularly palatable fish known as the snapper. The mountain streams, stocked with introduced trout, afford good sport for the angler, while the surrounding seas are favourite haunts of the sword fish and shark, both of which offer the most exciting contests to deep sea anglers.

The government of New Zealand is noted for the many advanced ideas it has put in

force. The state conducts many enterprises for the benefit of the citizens, such as life and accident insurance bureaux, an old age pension system, and loan banks for the benefit of settlers. Labour disputes must be submitted to a compulsory arbitration court. The railways are owned by the government, together with the coal mines which supply their fuel.

New Zealand has been a British Dominion since 1907, and includes, besides North and South Islands and Stewart Island, other remote groups, chief of which are Cook Islands to the north, the Chatham Islands to the east, and the Auckland and Campbell Islands to the south. The former German colony in the Samoan Islands is now ruled by New Zealand under a mandate from the League of Nations. On matters affecting Great Britain's international and imperial interests the British Government is consulted, but otherwise the Dominion legislates and governs as it chooses, under a Governor General appointed by the Crown, a Legislative Council, and a House of Representatives.

The largest cities of New Zealand are Auckland (*q v*), the chief seaport, beautifully situated on Hauraki Gulf to the north, Wellington (*q v*), the capital, on Cook Strait, and Christchurch and Dunedin, both on South Island. **Ney, MICHEL** (Pron *nā*) (1769-1815). "The harvest of the brave" was the title given by Napoleon to this great marshal of the "Grande Armée." Although of humble birth—the son of a cooper—Ney had become an under officer in a hussar regiment by the beginning of the French Revolution. When that



MARSHAL NEY—THE BRAVEST OF THE BRAVE

When the retreat from Moscow began, Napoleon left Marshal Ney to command the French Army and lead it back to France. The troops endured almost incredible hardships, and it was due to Ney that even a remnant of them survived. This painting by Adolphe Yvon, a nineteenth century French artist, shows Ney at the head of the French rearguard resisting an attack by the pursuing Russians. It was after the battle of Friedland, fought by the French against the Austrians and Russians, that Napoleon described Ney in the well known words "the bravest of the brave."

event opened up the way for advancement, promotion came rapidly as a reward for merit, and at the establishment of the empire, in 1804, Ney was made a marshal of France. He was a sincere admirer and staunch supporter of the emperor, contributing to the victory of Jena, and leading the attack at Friedland.

But it was in the Russian campaign that his bravery was most conspicuous. On the disastrous retreat from Moscow he protected the rear, encouraged the soldiers, and was himself the last to cross the Russian frontier. When the news of the escape of this "Lancelot of the Imperial chivalry" reached Napoleon, he exclaimed to his officers: "I have more than 400,000,000 francs in the cellars of the Tuileries, and would gladly have given all to ransom my faithful companion-in-arms."

But a few years later Napoleon in his far-away island-prison, St. Helena, heard without emotion the news that Ney had been shot as a

traitor. The reason for this change of attitude was that when Napoleon had been forced to abdicate in 1814, Ney had gone over to the royalists with loud protestations of devotion to the Bourbons. When Napoleon returned from Elba, Ney had again set out from Paris, boasting that he would bring back this disturber of the peace "in an iron cage." The fact that when he met his former commander, forgetful of his oath and dazzled by Napoleon's personality, he joined forces with him, fighting under him through the "Hundred Days" up to Waterloo, where he commanded the French centre, was unable to wipe out the memory of his defection.

It was for this rally to Napoleon that he suffered death by order of the Bourbons, and it was because he had broken his faith both with Louis XVIII and with Napoleon that the exiled emperor condemned him as "dishonourable." Brave in death, Ney faced a firing squad in Paris, December 7, 1815.

The WORLD'S most FAMOUS WATERFALL

Everyone who can visits the Niagara Falls, one of the greatest natural spectacles the world can provide for the tourist. It is useful, too, as a source of electric power, as this article explains

Niagara Falls. English novelist, once sights on earth which

Anthony Trollope, the wrote that "of all the tourists travel to see" he knew of none "so beautiful, so glorious, and so powerful" as the falls on the Niagara river, between Canada and the United States. Some people differ from him, and since the discovery of Victoria Falls in Rhodesia, Niagara Falls can no longer claim the distinction of being the greatest falls in the world. But certainly in point of scenic splendour they are not



only the most sublime among the foremost of "all beauties of Nature prepared by the Creator for the delight of His creatures."

Every minute of the day and night about 15,000,000 cubic feet, or more than 467,400 tons, of water are leaping, vaulting, catapulting madly over their precipice. Tumbling as it were from the blue of the very heavens, the water avalanches hurl themselves with fury upon the boulders some 160 feet below.

The torrents fall with such might over the ledge that they land some fifty feet in front of

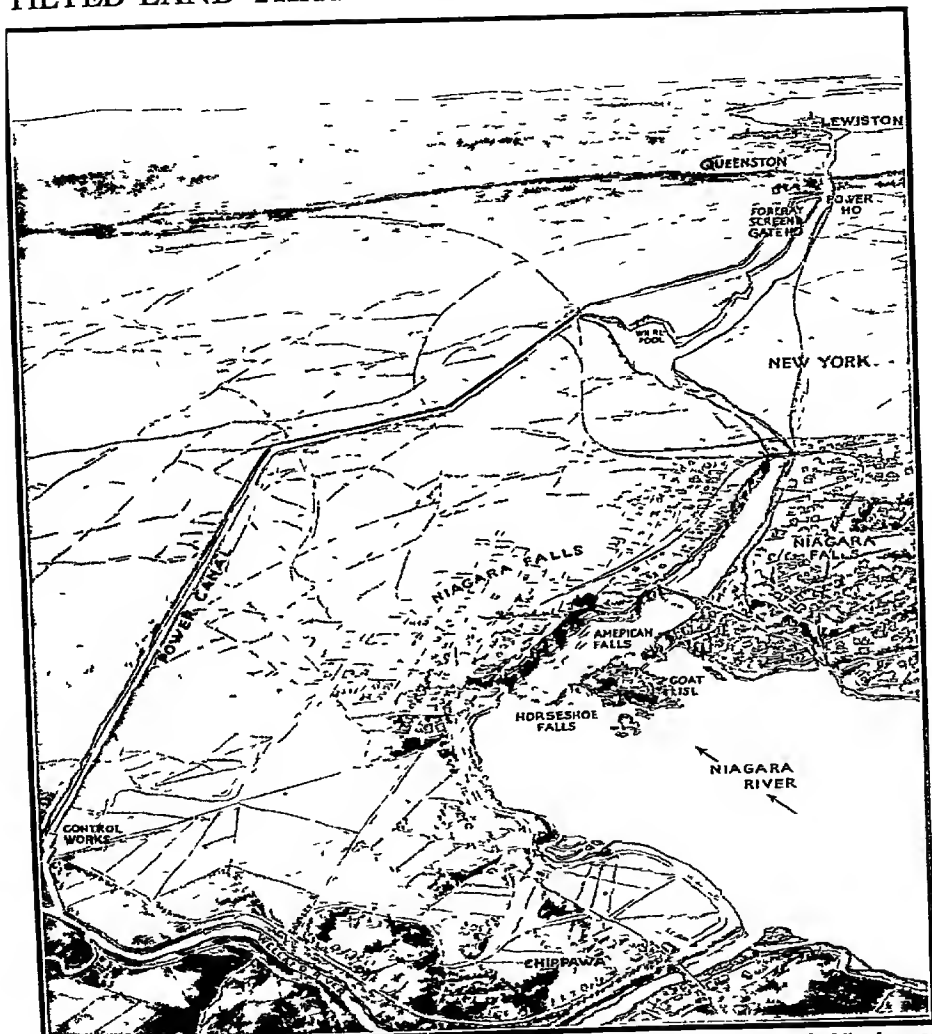
it, where they churn themselves into a boiling, seething, swirling cauldron. The ceaseless roar explains the name Niagara, meaning "Thunder of Waters," given by the Iroquois Indians.

In the centre of the river Goat Island splits the cataract into two falls—the Canadian on the left or west side, and the American on the right side. The former, called Horseshoe Fall because of its shape, measures about 3,000 feet on the curve. The American Fall, which is almost straight across, measures about 1,000 feet in length. Though its descent is a few feet greater than that of the Canadian Fall—167 feet, whereas the other is 158 feet—its volume of water is only one-twentieth to one-tenth of the total flow, hence the Canadian Fall is much the grander.

Caves have been formed under the majestic curved sheets of both falls, from which sight-seers, clad in waterproofs, obtain a magnificent view. The Canadian Fall has excavated a basin as deep as the height of the fall, which temporarily retards the waters and enables a little tourist steamer to poke her nose up into the mist. Scenic railway lines skirt the river.

Scarcely less marvellous than the falls are the river rapids above and below them. The Niagara river, part of the boundary between New York State and Ontario, is Lake Erie's outlet into Lake Ontario, thirty-three miles northward. The level of the latter lake is about 330 feet lower than that of Lake Erie, but for about

TILTED LAND THAT CREATED THE NIAGARA FALLS



If you will look northward into the distance, you will see the line of the "Niagara Escarpment" which created the falls. Ages ago Dame Nature broke the land in two along an east and west line, and pushed the southern portion up, so that now a great cliff fronts down upon the land between Queenston and Lake Ontario. At first the waters from Lake Erie poured over this cliff near Queenston but gradually they wore the rock back, until they brought the falls to their present position. The power canal is a recent project or Canadian enterprise, and is designed to furnish 300,000 horse-power in addition to that already developed in the immediate vicinity of the falls.

NIAGARA FALLS



VIEWING NIAGARA FALLS

Above is a general view of the world-famous Niagara Falls as seen from the Ontario shore. The Horseshoe Falls (right) are in Canada, while the others the American Falls, are in the United States. The two falls are separated by Goat Island. On the left are sightseers, dressed in waterproof clothing, exploring the falls by wooden structures which lead from rock to rock over the river.

Photos: top Canadian Lumber; below Keystone

twenty miles the river makes only a small portion of the descent. Then it narrows from about three miles in width to less than a mile, and in the remaining mile or so above the falls it descends fifty-two feet, gaining such rapidity as it dashes over its rocky bed that it forms the foaming Upper Rapids.

Making about half its total descent at the falls, the river enters the picturesque Niagara Gorge—flanked by perpendicular walls of rock 200 to 500 feet high—flows a couple of miles farther, and then forms the famous Whirlpool Rapids, extending for about a mile and descending about 100 feet. Lashing and booming their way over huge boulders at the rate of thirty miles an hour, these rapids are even more savage than those above the falls. Just below these rapids, the river, making a sharp turn to the left, has worn into the rock a large circular basin. This is the celebrated Whirlpool.

Fed by the mighty reservoirs of the Great Lakes, Niagara pours over its precipice a



NIAGARA

volume of water great enough to develop over 3,975,000 horse power. If the full drop from lake to lake were used, over 6,000,000 horse-power could be attained. At present well over 1,000,000 horse-power has been "harnessed."

Although little was done towards the "harnessing of Niagara" until the invention of the dynamo and the transmission of energy by electric cable, the building of power houses and factories soon after threatened to destroy the falls as a spectacle by the withdrawal of water above the brink. To guard against this, in 1910 the governments of the United States and Canada made provision for restricting the water used for industrial purposes to 20,000 cubic feet a second on the American side, and 36,000 cubic feet a second on the Canadian side.

Niagara has inspired many feats of reckless courage and skill. The tight-rope walker, Blondin, not only crossed on his rope but took a passenger in a wheelbarrow. Others have perished in trying to go over the falls in barrels, or to swim the rapids, which have, however, been swum twice by Lord Desborough.

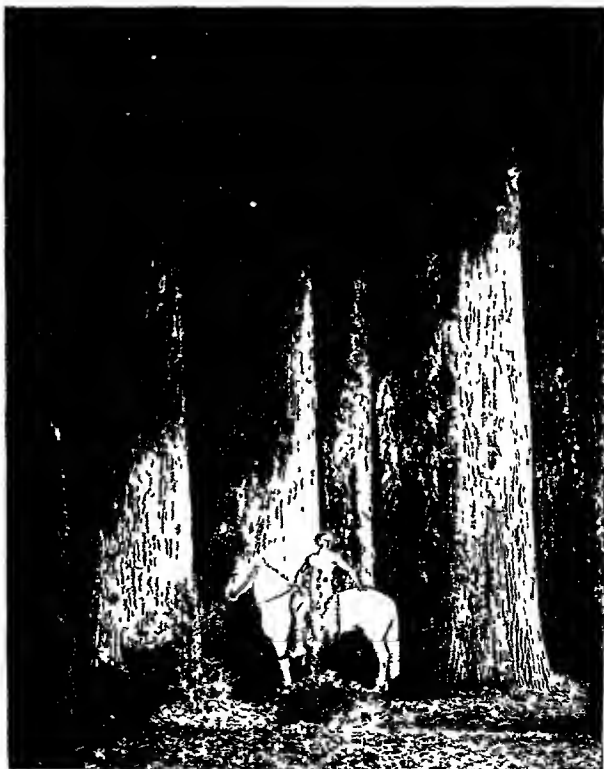
Nibelungs, Song of THE (Pron nē-be-loong?) Long ago in the Middle Ages, when frowning castles crowned the hill-tops of the Rhineland, wandering minstrels roamed through the country. With song and story they gained entrance to formidable fortresses which had never opened their gates under the onslaughts of enemy hordes. Gathered round a crackling fire of great logs, the warrior lords and their followers would listen for hours to the lays of the minstrels.

The tales of a mythical German race called the Nibelungs were a favourite theme for song, and glorious were the deeds of the gods and warriors of whom the minstrels sang. Later on these lays were written out and collected into a book called the "Nibelungenlied," or "Song of the Nibelungs," and on this collection have been founded many famous works

NIBELUNGS

Some of Wagner's starring operas, the cycle known as the "Ring of the Nibelungs," were taken from this source.

Once upon a time, one of the older versions states, three gods, Odin, Loki, and Hoenir, visited the earth, and while wandering near a stream saw an otter devouring a salmon. They killed and skinned the otter, and, hearing the pelt with them, sought shelter for the night in the abode of Rodmar, a greedy, heartless miser. Rodmar recognized the pelt as being that of one of his sons, who had the power of changing his shape. He demanded as pay



SCENE IN THE NIBELUNG SAGA

This is a scene in the famous German UFA film of the Nibelung Saga, featuring the hero Siegfried, played by Paul Richter. The incident shown takes place during Siegfried's dragon hunt; he has just heard the dragon's movements and has stopped to listen. A second later he turns his horse and gallops to the fight.

(*wergild*) for the slaying of his son as much gold as would completely cover the otter pelt

To get the gold the gods hastened to the river and seized a priceless treasure which was guarded by a giant fish, but when all was heaped upon the pelt one hair remained uncovered. Yielding to Rodmar's demand, Loku placed on this a ring which bore this curse "Evil shall come to him who wears it." This treasure passed after a time into the hands of the Nibelung kings, and played its tragic part in the "Nibelungenlied."

Siegfried in the Saga

In the "Song of the Nibelungs" the hoard is found in the possession of Siegfried, a daring warrior, who has slain the two kings of the Nibelungs to obtain it. Little mention is made of the curse, and the story deals chiefly with the adventures and loves of humans, the gods having altogether disappeared from the scene. The plot centres around Kriemhild, the beautiful sister of Gunther, king of the Burgundians, who holds his court at Worms, on the middle Rhine. Siegfried comes to Worms to woo Kriemhild, and in due course they are wedded.

Many characters are introduced into the story, one being Brunhild, an Icelandic princess of wonderful beauty and enormous strength. Only he who could overcome her in deeds of skill and strength might win her love and hand. King Gunther, attracted by the fame of her beauty, goes to woo her, and Siegfried accompanies him as his friend and ally. Wearing a cloak of darkness which makes him invisible, Siegfried helps Gunther in defeating Brunhild

in three tests of prowess—hurling the spear for him, putting the weight, and jumping with Gunther in his arms far beyond the limit that Brunhild could reach. So Gunther weds Brunhild, and she comes to dwell in the court at Worms. Later on she learns of the deception practised upon her, and that Siegfried and not Gunther was the warrior worthy of her hand.

Not long after, Siegfried is treacherously slain by one of Gunther's followers, and Brunhild slays herself with his sword. Kriemhild vows vengeance on her brother, for she knows that he is really responsible for her lord Siegfried's death. She marries Etzel (Attila), king of the Huns, and after many years invites Gunther to visit the kingdom. He comes, bringing his followers, but is overcome. Gunther is put to death, and Siegfried is thus avenged.

The treasure again enters the story at this point, Kriemhild demanding from Hagen, a vassal of Gunther and the slayer of Siegfried, the secret of the hiding-place of the hoard. He refuses to impart it, saying

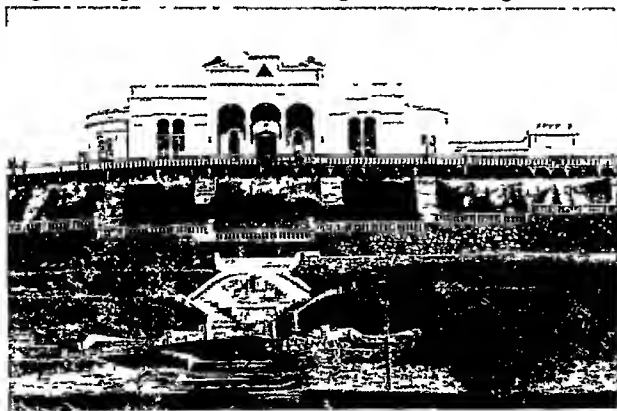
None knoweth of the treasure save God and me alone
And unto thee, she devil, it never shall be known

Enraged, Kriemhild grasps Siegfried's sword and decapitates Hagen, but is herself slain by a follower of Etzel.

Nicaragua. The largest of the Central American republics (area, 51,660 square miles) but the most thinly populated (there are only about 750,000 inhabitants), Nicaragua stretches across the isthmus from the Caribbean to the Pacific coast. Although it lies in one of the most dangerous volcanic regions of the earth, Man has

done more to retard its progress than has Nature. The eruptions of lava have created a marvellously fertile soil, but the century of civil strife that followed the country's declaration of independence in 1821 has laid waste the cultivated plains time after time and made steady progress impossible. The United States has several times intervened, and Marines were frequently stationed from 1912 to 1933.

As in most countries of Central America, the majority of the people live along the volcanic Pacific slope. The principal port is Corinto, in the north, from which nearly two-thirds of the country's shipping is done. Leon, about twenty-five miles to the south-east, with a population of 23,600, has public buildings considered among



PALACE OF THE PRESIDENT OF NICARAGUA

Since its destruction by earthquake in 1931, much of the city of Managua, Nicaragua's capital, has been rebuilt. Among the new buildings is the president's palace, seen in the photograph above, which stands on the fortified hill called "La Loma."

NICARAGUA

the finest in Central America. Still farther south is the capital, Managua, almost completely destroyed by earthquake in 1931, near the foot of a mile high pyramidal cone, Momotombo, on the south shore of Lake Managua, which is surrounded by volcanoes. Granada, a city of 18,000 people, stands on the beautiful Lake Nicaragua, which is also set about with giant volcanoes, their green-clad sides beautifully laid out with coffee plantations. Lake Nicaragua, 110 miles long and 3,000 square miles in area, is the largest lake in Central America. A canal right across Nicaragua, to include the lake, has long been projected.

On the uplands near the Pacific the climate is mild, but elsewhere it is distinctly tropical, with a mean temperature of 80 degrees. There are only two seasons, wet and dry. **Nice**, (Pron nēs), **FRANCE**. Tucked in between the mountains and the sea, at the north of the Gulf of Genoa, is the veritable little fairy-land known as the Riviera. Behind it rise the Maritime Alps in sharp sea-crags and great rocks like ruined towers, affording it protection from the harsh north winds. To the southward stretch the shimmering blue waters of the Mediterranean.

Between, in a great crescent, lie the flower-decked foothills and the shining shores from which come so many fruits, perfumes, and flowers. Trees grow here which are not usually found so far north—date palms and bananas, pepper trees, the eucalyptus, and the prickly pear. Olive-groves alternate with acres of roses, violets, and hyacinths. Here many thousands of tired or ill people have been made well again.

At the extreme western end of the Riviera, in the small part that belongs to France—for most of it is in Italy—is the famous pleasure city of Nice. Here people go in thousands every year to bask in the sun, to throw flowers and confetti at one another in the famous carnival, to watch the fireworks from the gardens on the front, and to gamble at the Casino.

The town itself is divided into three parts—the New Town, the Old Town, and the Port. Nice has a cathedral, a museum, an observatory,

and a well-stocked library. Its main export is olive oil. Besides oil-works it has perfumery factories, soap works, tanneries, and furniture factories.

Greek colonists of Marseilles first settled in Nice over 2,000 years ago, and its name (Latin *Nicea*, from Greek *nike*, "victory") is derived from a victory over the neighbouring tribes. It became subject to Rome in the 2nd century B.C., and since then has suffered in many wars and at the hands of many races. It was once in the grip of the Saracens, once the Turks pillaged it, and it has belonged to Provence, Savoy, and

Sardinia-Piedmont.

In 1860 it was ceded to France as the price of aid rendered in creating the present kingdom of Italy. Its most famous son was Garibaldi, the knight-errant of Italian unity. Nice, like all the Riviera, has at times slight earthquakes. In the last century it suffered four times, the most serious being in 1887. The population of Nice is about 241,000.

Nicholas. TSARS OF RUSSIA. An attempted liberal revolution (the "Decembrist" rising), when, in 1825, he succeeded his brother Alexander I, made Tsar **NICHOLAS I** (1796-1855) a thoroughgoing reactionary. An iron despotism and an elaborate spy system gripped Russia in his reign, and though he

warred against Turkey in 1828-29 to enable the Greeks to win their independence, he used his armies to crush the Hungarian rising against Austria in 1849.

The chief event of his reign was the Crimean War (1854-56), which he began with a view to securing Constantinople and the lion's share of the inheritance of the Sultan of Turkey. Chagrin at the failure of these plans due to the aid given to Turkey by Great Britain, France, and Piedmont, was probably a factor in his death, which took place, March 2, 1855, a year before the end of the war.

NICHOLAS II (1868-1918), the last of the Tsars, reigned from 1894 to 1917. Great grandson of Nicholas I, he succeeded his father Alexander III on October 24, 1894. A weak but well-meaning ruler, he was influenced largely by his



CARNIVAL AT NICE

Nice, famous pleasure city of the French Riviera, is renowned for its carnival festivities. Above is seen the annual procession of 'King Carnival,' with its accompaniment of triumphal cars, grotesque giant figures, and false faces.



NICHOLAS II AFTER HIS FALL

The photograph shows the last Tsar of Russia, Nicholas II, in captivity at Tsarskoe Selo, shortly after the Russian revolution of 1917. Later, he and his family were sent to Ekaterinburg, in eastern Russia, where they were brutally murdered on the night of July 16-17, 1918.

wife (a German princess), who in turn was under the influence of the reactionary element at the Russian court.

The first Hague Conference called by the Tsar in 1899 to consider disarmament, showed a sincere desire to remedy the evils of militarism, but the disastrous Russo-Japanese War (1904-1905) showed equally clearly that the corrupt military and bureaucracy still controlled Russia.

Widespread revolutionary movements which followed that war forced the Tsar to call together the Duma (legislative assembly), which was expected to end autocracy and introduce constitutional government, but by successive interferences with the Duma and the electoral law it was robbed of all power. When war threatened in 1914 Nicholas II was torn between his desire to protect Serbia against Austria and his fear of a general European war.

When the World War came, the criminal corruption, negligence, and lack of ability of the Tsar's officials brought severe defeat to Russia in the first two years. The inefficiency of the ministry, the failure to co-operate with the Duma, the suspicion that the court party meditated a

separate peace with Germany and the forfeiture of public respect through the influence of the "holy man" Rasputin over the Tsarina and the feeble Tsar made a revolution inevitable.

The storm broke in March, 1917, and Nicholas was forced to abdicate the Russian throne. Immediately he became virtually a prisoner, and he and his family (the Tsarina and their four daughters and one son) were eventually carried to Ekaterinburg in the Ural Mountains. There they lived until, on July 17, 1918, the Tsar and his entire family were brutally murdered by order of the local Soviet.

Nickel. This is a metallic element, white with a faint yellow tinge, hard, ductile, malleable, slightly magnetic, and capable of taking a high polish. This last property, coupled with the fact that it rusts very slowly, makes it useful as a coating for other metals. The nickel coat is applied by the process of electro-plating (*q. v.*). Alloyed with two parts of copper and one of zinc, nickel forms a bright silvery metal known as "German silver" or "nickel-silver," largely used for making cutlery, table-ware, and as a basis for silver-plated ware. Alloys of copper, tin or zinc and nickel are used for coins. The American "nickel" coin (value 5 cents) contains one-fourth nickel, the rest being copper.

About 40 per cent of the world's nickel production goes in the manufacture of nickel steel, an alloy which is especially adapted to withstand repeated strains. It is used in armor-plate, cannon, structural work, bridges, railway rails and axles, steel castings, engine forgings, and shaftings and valves, especially in motor-cars and railway carriages. Combined with copper and rolled into sheets, nickel is used for bands on shells and bullet jackets. Alloyed with copper, iron and cobalt it forms a valuable rust-resisting material.

A combination of nickel steel with manganese, silicon, and chromium gives the hard alloy *invar*, which is much used for measuring-instruments and pendulum rods, because it is practically non-expansive. A nickel steel containing carbon has almost the same rate of expansion under heat as glass, and so may be used as a substitute for platinum for the wires in incandescent electric bulbs.

Nickel is dissolved with difficulty by most acids, except nitric acid, which readily attacks it, and forms a green solution. The green liquid sometimes seen in glass vessels in chemists' windows is often a nickel salt dissolved in water.

The chief sources of nickel are Sudbury, Ontario, and New Caledonia Island.

Nicknames. "Nicknames and whippings," said Walter Savage Landor, "when they are once laid on, no one has discovered how to take off." Nations, like persons, have nicknames which grow up in curious ways.

NICKNAMES

"John Bull," the personification of the English nation, is represented as a stout, ruddy faced, matter-of fact, blunt fellow attired in leather breeches and top-boots, generally with a cudgel in his hand and a bulldog at his heels. The name "John Bull" was first used in a political satire published by Dr Arbuthnot at the time of the War of the Spanish Succession, in Queen Anne's reign.

The nickname "Uncle Sam" applied to the United States is known the world over. This is the way it originated. During the War of 1812 someone inquired as to the meaning of the letters "U S" stamped on government goods. He was told that they stood for "Uncle Sam," the local title for Samuel Wilson, the government inspector. This jest was repeated throughout the country, the name stuck and "Uncle Sam" came to personify the United States government and the American people. Uncle Sam is always portrayed as a tall thin man with



JOHN BULL
After a drawing by Sir John Tenniel reproduced by permission of the proprietors of "Punch"

NIGER

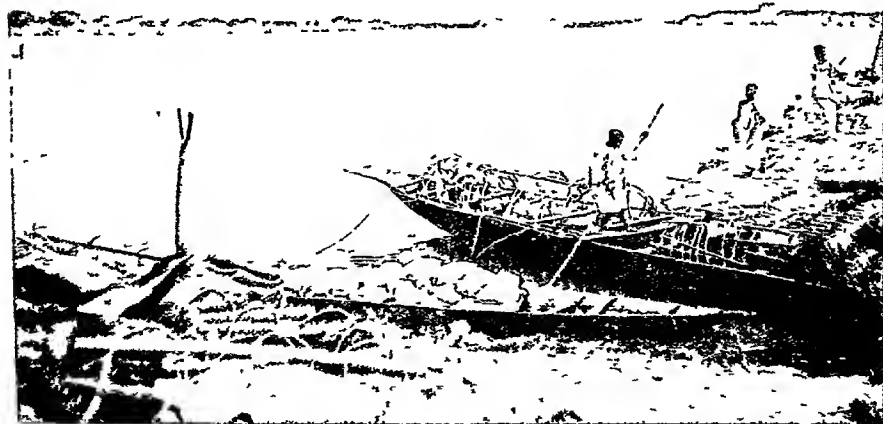
long narrow beard, long tailed coat, high hat, and a shrewd, but humorous, countenance—attributes which marked the typical American of the early days. Americans of today are often called Yankees.

Not very complimentary nicknames include "Froggies" for Frenchmen (because they eat frogs) and the American slang names, "Wops," of doubtful origin for immigrants from the south of Europe, especially from Italy, and "daggoes," from the Spanish Diego (James), a contemptuous term for Spaniards or Italians.

Places, too, have nicknames, of which perhaps the most famous is "Pompey," the name given by sailors all over the world to Portsmouth. And regiments, too, and ships may have them. The 19th Lancers were called from their motto the "Death or Glory Boys," and the Yorkshire Regiment as "The Green Howards."

Some people have thought that the word nickname came from "nick," to cut, since a nickname is often a shortened form of the full name, but a nickname was originally "an eke name," and meant an added name.

Niger, (Pion ni'-jei), RIVER. To see the soul of tropical Africa, there is nothing better, perhaps, than a voyage down the great river Niger, next to the Congo and the Nile the largest river in the Dark Continent. Its course of



THE BROAD WATERS OF THE MIGHTY NIGER

The third longest river of Africa and the main waterway of the western equatorial region, the Niger is seen above where it flows past the town of Jebba. Here the river makes a loop that forms an island, which is a stepping stone for the bridge carrying the Lagos railway. Notice the quaint native craft in the foreground, one with a skeleton of bamboos and branches which is covered with mats in the rainy season.

2,600 miles leads through mountainous uplands, traverses broad, flat prairies, skirts the vast sandy wastes of the Sahara Desert, plunges through giant forests, and feels its way to the ocean through a score of mouths bordered with mangrove swamps.

Rising only 150 miles from the sea, in French Guinea, above Sierra Leone, it sweeps first north-eastward, then south-eastward, then straight south into the Gulf of Guinea, forming a great arc which encloses one of the richest and most picturesque of African territories—a region chiefly divided between France and Great Britain (See West Africa)

The Niger is of immense importance as an artery of trade. Steamers of light draught can make their way over most of its length, and through its largest tributary, the Benue, it provides a highway for 900 miles eastward into Central Africa. A railway, one of several, connects the upper reaches of the Niger with the river Senegal, emptying on the west coast. There are also many new roads into the heart of Nigeria. Thus travellers can reach the markets of Sansanding, Segou, Timbuktu, and other river stations far in the interior towards the desert. The Niger shipping is chiefly engaged in transporting the palm-oil, oil seeds, copal (a resin used for varnishes), tree-gums, rubber, coffee, ivory, and other products of this vast and luxuriant river basin.

The Niger delta is one of the most remarkable in the world, consisting, from 40 to 70 miles from the sea coast, of a great network of interlacing creeks and broader channels, in which mingle the waters of small independent streams until it is impossible to trace the main river. The chief entrances for large ships are the Nun Mouth, the Forcados, the Brass Mouth, and the Bonny. The climate of the delta is one of the most unhealthy in Africa, but the British colonists in this portion of the Niger valley are slowly stamping out disease spread by mosquitoes and the dreaded tsetse fly.

Nightingale. No bird has been more celebrated in literature than the nightingale, from Greek times up to our own. Homer wrote of the "sweet, tawny nightingale", Milton called it the "most sweet, most melancholy bird," and Keats is writing of the nightingale when he refers to the

song that found a path
Through the sad heart of Ruth, when, seek for home
She stood in tears amid the alien corn.
The same that oftentimes hath
Charm'd magic easements, opening on the form
Of perilous seas, in faery lands forlorn.

This bird (*Dauhas lusama*) is found throughout Europe, most abundantly in southern

France, Spain, and Portugal, and in parts of England. Its song is heard most frequently in the spring, for a few weeks after its return from the south. The Persian bulbul (*D hafiz*) and another species of night-singing bird found in Asia, are probably the nightingales of the Persian poets and the Greeks and Romans.

During the mating and nesting season—from the middle of April to the middle of June—the male, perching near his tiny house, sings both day and night. He is heard chiefly in the night, because then most other birds are silent, and the last two weeks of May and first of June show his song at its best. His song is a melodious outpouring of glorious tone, and although there are several very distinct phrases, these may be repeated in varying order,

the song following no set plan. Nightingales differ, and though a poor one may be no better than many warblers, a good one, once heard, is never forgotten. They are bold singers, too, giving their performance often within a few feet of the noise and lights of a main road at night.

The bird is about six inches long, with rusty-brown and grey plumage, and is shy and quiet, frequenting shrubs and low trees.

The nest is very loosely built of grass-stalks and dry leaves, and is usually discreetly hidden in a dense thicket of hrambles or nettles. The eggs are brown.



GOLDEN-VOICED NIGHTINGALE

Almost all over the temperate zone of the Old World the summer nights are made musical by the sweet notes of the nightingale. In this photograph a cock nightingale is seen bringing a meal to his nest.

'The LADY with the LAMP'

One might say that the lamp which Florence Nightingale carried round the wards of her hospital shed a light throughout the world, for it was she who raised nursing from drudgery to a noble profession

Nightingale, FLORENCE (1820-1910)

This Englishwoman, the first and greatest of women war-nurses, who revolutionized the methods of caring for sick and wounded soldiers, was born in the city of Florence, Italy, but she grew up on her father's estate at Lea Hurst, Derbyshire. There, while still only a child, she helped a doctor to set and bandage a colt's broken leg, and nursed the grateful animal back to health. As a girl she made "patients" of all the sick and aged in her village, and, much against her parent's wishes, would visit them with invalid food she had herself prepared, and with bandages and other dressings she had made at home. Her treatments were so successful that, at that early age, she vowed to devote herself to nursing the sick—though this proposition was laughed to scorn by her relations and friends, so despised was the nursing profession in those ignorant and callous days. At eighteen she "came out" and was presented to the young Queen Victoria, as any girl in her position would be.

As a debutante in court circles she could have had a gay season and perhaps made a brilliant marriage. But, caring nothing for society, she spent her time in studying the work of the great hospitals. In a year or so she left her beautiful home and her friends for the hard training of a nurse in convent hospitals on the Rhine and in Paris. At that time it was

an unheard of thing for a gentlewoman to become a professional nurse.

Returning to England, Miss Nightingale attracted attention by reorganizing the Hailey Street Home for Sick Governesses. She was 34 years old and already widely known in the medical world when the Crimean War broke out and a British army was sent overseas to help Turkey against Russia. When reports came of the terrible sufferings and high death rate of the sick and wounded English soldiers and sailors, she offered her services to the Government. Within a week she enlisted 37 nurses, filled a ship with supplies, and embarked



'AN ANGEL OF MERCY' ON HER HOSPITAL ROUND

This engraving depicts Florence Nightingale visiting the sick and wounded in the military hospital at Scutari during the Crimean War. Her sympathetic presence did much to hearten the sufferers, and her habit of visiting all the wards at night, lamp in hand, speaking words of kindly consolation, won for her the affectionate title of 'The Lady with the Lamp'.

for Scutari, where she arrived in time to receive the wounded from the battle of Balaklava.

The story of Miss Nightingale's heroic labours in hot and unhealthy camps, and in barracks which served for hospitals, is one of the most noble chapters in British military annals. England's bravest and best were dying like flies when she took charge. She soon changed overcrowding, confusion, dirt, and neglect into space, order, cleanliness, and prompt attention. The death-rate fell from 42 to 2 per cent. When stricken with fever herself, she refused to leave her post. No matter how long and hard the day's work had been, she always made the night

rounds of the wards, lamp in hand, to see that the attendants were on duty, and to speak cheering words to her charges. Ever afterwards she was known to Englishmen with grateful affection as 'The Lady with the Lamp'.

When the war was over, a British naval vessel was dispatched to fetch Miss Nightingale home, but, taking a French steamer, she slipped into England unnoticed. The fund of £50,000 that was raised for her by popular subscription she used to found the Nightingale Home for Convalescents. Queen Victoria's comment after Florence Nightingale visited her at Balmoral was "Such a head! I wish we had her at the War Office!"

Miss Nightingale's health had been so undermined by her war-work that, although she lived to the age of 90, she became a permanent invalid. Nevertheless, her life continued to be one of the widest usefulness. She wrote standard books on nursing, and advised many countries on the building and managing of public, private, and military hospitals. No one else did so much as she to raise the profession of nursing to its present place of honour.

Apart from her work and writings in connexion with the military and civil hospitals and nursing, Miss Nightingale was very keenly interested in hygiene and sanitation generally. On these subjects she gathered all the information she could find, and thus kept herself well abreast of the many improvements in these branches of knowledge.

In her nursing experience Miss Nightingale had always laid great stress on the importance of fresh air, cleanliness, light, diet, etc., and this principle she was very anxious to see extended to ordinary everyday life. When she was 72 years of age she did not consider herself too old to take a large part in organizing an elaborate health campaign in Buckinghamshire. Competent instructors were secured, and these were sent on a tour round the villages, giving advice on ventilation, drainage, and other points.

In 1907 Miss Nightingale was awarded the Order of Merit, an honour which only twenty-four British people may receive, and which had

never before been given to a woman. She died on August 13, 1910.

Nightjar. Probably no bird has so many nicknames as this, and certainly none has such strange ones. Night hawk, dor hawk, fern-owl, moth-owl, hoh-fowl, puckeridge, goat-sucker, and flying toad—these are some of the names it goes by in various parts of England. Perhaps on account of its nocturnal habits and its strange appearance when seen at short range, it has been considered to have something to do with evil spirits—hence the names puckeridge and hoh-fowl, for Puck is always a naughty spirit, and "hoh" is a corpse. The name goat-sucker



FLORENCE NIGHTINGALE AT HOME

This is one of the last portraits taken of Florence Nightingale, who did so much to mitigate the sufferings of the sick and wounded during the Crimean War. She helped to found several schools and institutions for nursing, and in her later years did much to promote rural hygiene.

(Photo S. G. Layne from "The Illustrated")

refers to an idea that these birds take the milk from goats, while some of the other names refer to the nightjar's food—large nocturnal moths and beetles.

The nightjar (*Caprimulgus europaeus*) is a medium-sized, grey-and-brown mottled bird, with long wings and tail like those of a hawk, but plumage as soft as that of an owl, so that it is absolutely silent in flight. It has a very large gaping mouth, so that, although the beak is small, the head seems to open right up as the bird sweeps along in its search for food. The cockchafer and similar insects are said to be called up by the strange "churring" sound of the nightjar, made as it sits along—never across—some low branch of an old oak or other tree. This sound is very like that of a motor-cycle going slowly but steadily along a distant road. At the same time, it is the bird's only song.



MRS. NIGHTJAR AND HER FAMILY

The little nightjars have no warm nest in their babyhood, and have to huddle together on the bare ground, like those shown here under the eye of their mother. That eye is so placed that it can see forwards or backwards.

The nightjar builds no nest, but lays its strangely mottled eggs—usually two in number—on the bare ground. So well do both eggs and mother bird resemble their surroundings that they need no further protection, and you may almost tread on a sitting nightjar before it rises.

Nightjars, which are migrants so far as the British Isles are concerned arriving in May and departing in September, are widely distributed in the northern temperate regions.

The Virginian nightjar, locally known as the night hawk, is famous for its high dive. With wings almost folded, it plunges downwards from a height of several hundred feet until within a few feet of a housetop or the ground. Then with a sudden spreading of its wings it checks its giddy descent and swoops upwards, to repeat this thrilling exhibition over and over again. All these birds sleep sitting lengthways on a branch, instead of sideways, as most birds do.

A well-known North American species is called, from its note, whip-poor-will. In South America there is a group of nightjars with tremendously long, forked tails.

Nightshade. Growing here and there in the waste places of various parts of the world, and especially in dry, neglected gardens, is a weed, related to the potato, whose slender, erect stem, pointed oval leaves, drooping clusters of white and yellow flowers, and small, rather round berries are often regarded with suspicion. However, it is only when animals chew the fresh leaves of this common or black nightshade (*Solanum nigrum*), or when people eat too many of its berries, that injury results. The leaves are holed in some warm climates where the plant makes vigorous growth, and are eaten as a sort of greens.

Another plant of this nightshade group is the bittersweet (*S. dulcamara*), whose somewhat poisonous scarlet berries taste both bitter and sweet. This species is easily recognized by its flowers, which are purple with a yellow centre. It is often called "deadly nightshade," but that plant belongs to another genus. The true deadly nightshade (*Atropa belladonna*) is found in various parts of Europe, Africa, and Asia, and its leaves and roots are particularly used in medicine. This is a disagreeably smelling shrub with dull green leaves, purple bell-shaped flowers, and black cherry-like fruit. Because it can dilate the pupil of the eye, atropine, obtained from this plant, is used by oculists. The deadly nightshade is found in various parts of England especially on soil containing chalk or limestone. You can tell it because the leaves grow in pairs, of which one is large and one small, and that, together with the small, the form of the flowers, and the berries, will help you to know and to shun this deadly plant. It grows to a height of 3 or 4 feet.

Nile, River. For thousands of years there has been a question as to where the Nile, the longest river of Africa, may be said to begin. In one sense it begins at Khartum. Here the Blue Nile, flowing clear and blue from the Abyssinian mountains, or reddish-brown in flood time, meets the greyish-green White Nile, which comes from the lake region of Central Africa. The sources of the Blue Nile were known in ancient times, but of the White Nile



NIGHTSHADES DEADLY AND BLACK

The upper picture shows the berries of the deadly nightshade, or dwale, perhaps the most dangerous poisonous plant of the countryside. Beneath are seen the clustered berries of the black nightshade, also poisonous but in less degree.

Photos A. W. Dennis and J. J. Bedford

the geographers told legends of the Mountains of the Moon and of underground channels

It is only in recent times that explorers have followed it back through the swampy *sudd* region, with its dense floating vegetation and its mosquitoes, past the rapids and waterfalls in which it descends from Lake Albert or Albert Nyanza (*nyanza* means "lake") to the lake itself, and thence through the beautiful gorges of the Victoria or Somerset Nile, which feeds Lake Albert to Lake Victoria, and afterwards to the streams which are discharged into this lake

From Khartum to Assuan the Nile descends in six cataracts. After Khartum it receives only one tributary, the Atbara, another Abyssinian stream, which is 600 yards wide in flood time and at other times almost dries up so that fish, turtles, crocodiles, and hippopotami remain imprisoned in the deep pools of its upper reaches until the next flood-time.

After watering the whole land of Egypt and passing through the capital, Cairo the Nile finally reaches the Mediterranean through two channels. These are called the Rosetta

and the Damietta mouths, and the general region is known as the Delta. Having received no new tributaries and having lost much through oozing and evaporation, the Nile ends as a smaller river than it was higher up.

The yearly flood of the Nile has for centuries been the secret of Egypt's fertility. The heavy April rains in the basin of the White Nile start the first flood, and the May rains in Abyssinia give the real flood of rich muddy water that fertilizes as well as irrigates. The great dam at Assuan, together with the dam at Sennar on the Blue Nile and several

others store up the surplus flood and release it later on so that the Nile valley may be watered all the year round. The length of the Nile from Lake Victoria to the Mediterranean is about 3,470 miles. The Blue Nile is about 840 miles long.

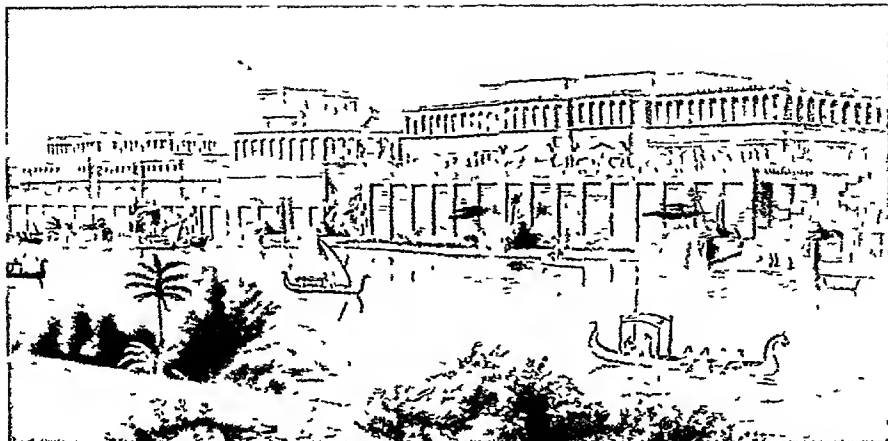
Nineveh. (Pronounced "Nin-ee") When the people of Israel were groaning under the yoke of the proud and ruthless Assyrian kings, the Old



THE NILE SEEN FROM ONE OF CAIRO'S BRIDGES

Dorlan Leigh

Longest river of Africa, the Nile is of vital importance to Egypt and the northern part of the Sudan, since the fertility and prosperity of these countries is entirely dependent on the irrigation of the land by its waters. A remarkable journey by the English explorers J. H. Speke and J. A. Grant, in 1860-1863, gave us our first real knowledge of the sources and extent of this great river. The photograph above was taken from the Kasr-en-Nil, or Great Nile bridge, which spans the river between Cairo and the island of Gezira.



NINEVEH, CAPITAL CITY OF ASSYRIA, IN ITS ANCIENT GLORY

The ancient capital of the Assyrian empire lay on the left bank of the upper reaches of the Tigris, opposite where today lies the town of Mosul. In the seventh century B.C. when the men of Nineveh were defeated by the Medes and Chaldeans, the city was looted and laid waste. Numerous excavations have been carried out on the site of this ancient city and from the knowledge so acquired the above sketch was made showing how Nineveh must have looked in the days of its glory.

Testament prophets called down the vengeance of Heaven on Nineveh, the splendid capital of the Assyrian Empire. "The Lord will make Nineveh a desolation and dry like a wilderness."

The prophecy was fulfilled when the hordes of the conquering Medes and Chaldeans more than 25 centuries ago (606 B.C.) swept over the doomed city and made it a desolate waste. As the centuries went on, the sun-dried bricks of which most of the houses were built crumbled to dust and the drifting sands covered the ruins, mounting higher and higher, until every trace of the once mighty capital was lost.

Digging in Nineveh's Dust-heaps

It was not until the middle of the 19th century that scholars set to work on the vast flat topped mounds with pick and shovel, and uncovered evidence that they did indeed mark the site of one of the most magnificent capitals of antiquity. More than that, the walls and sculptures and libraries they brought to light have enabled learned men to rewrite the great lost chapters of history that tell of the empire of the Assyrians. Nearly every important fact we have today about Assyria has been discovered since our grandfathers went to school, as the result of the excavations at Nineveh and other sites in the ancient valleys of the Tigris and the Euphrates.

One of the earliest and most successful of these investigators was Sir Austen Layard, who

unearthed the great palaces of Sennacherib and Ashurbanipal in 1845-51 with their alabaster bas reliefs of hunts and sieges and battles, and colossal winged man-headed statues of bulls and lions. Most important of all, he found in my thousands of tablets of Ashurbanipal's library, which have now been deciphered and tell us the story of science history, religion, and literature in those days in Assyria, and Babylonia as well.

The mounds, which extend at intervals for some 15 miles along the Tigris opposite the modern city of Mosul represent not only the city of Nineveh proper but also Dur Sargan, the city of Sargon II, and Kalah. Nineveh, though it existed at least as early as 2000 B.C. was chiefly the creation of Sennacherib (705-681 B.C.), who walled and fortified it for two and a half miles along the Tigris, building a great new palace and laying out extensive gardens. He also improved the supply of drinking-water by means of conduits from the hills. It was the destruction of these conduits which made a wilderness of Nineveh.

Niobe. (Pron. nī' o bē) One of the saddest stories in Greek mythology is that which tells how the proud Niobe, daughter of Tantalus and wife of Amphion, king of Thebes, was punished for her presumption. She boasted of her seven sons and seven daughters and despised the goddess Leto (Latona) who had only one



NIOBE AND HER YOUNGEST CHILD

In Greek and Roman mythology we read the sad story of Niobe, whose seven sons and seven daughters were killed by Apollo and Diana. This statue shows the tragic mother trying to shield her youngest child from the vengeful deities.

Uth: Gallery Florence photo Alinari

son and one daughter. But the children of Leto were the great Apollo, god of the sun, and Artemis (Diana), goddess of the moon, and for this arrogance they slew all the children of Niobe with their arrows. Niobe's grief was so great that Zeus out of pity changed her into a rock on Mount Sipylus, from which tears continued to flow.

Nitric Acid. The most deadly explosives known are made by the action of nitric acid upon various organic compounds. The pure acid is colourless, and is about half as heavy again as water. It colours the skin yellow and causes severe burns. Nitric acid attacks and breaks up most substances with which it comes in contact. It also dissolves most of the ordinary metals, except gold, platinum, and aluminium. It used to be called "aqua fortis."

Nitric acid is chiefly made by distilling a mixture of Chile saltpetre (sodium nitrate) and sulphuric acid and condensing the vapour. In the electric arc, nitrogen and oxygen of the air combine to form the gas nitrogen peroxide, which, when cooled and brought into contact

with water, makes nitric acid. This is one of the best-known ways of converting the free nitrogen of the air into a fixed form for use in agriculture and the industrial arts.

When the metals, or their compounds with oxygen, or carbonates, are dissolved in nitric acid, salts called nitrates are formed. Some of these nitrates are useful in medicine, others are in common use as fertilizers, and still others make the red and green lights in fireworks. Nitric acid and sulphuric acid act on cotton and glycerine to form nitro-cellulose and nitroglycerine, which are strong explosives. Trinitrotoluene—the T N T with which shells were filled and which had many other uses in the World War—is also a derivative of nitric acid.

Nitrogen. Four-fifths of the great sea of air that rolls about the earth is free nitrogen—nitrogen which is not combined chemically with any other element, but merely mixed with free oxygen. That is nitrogen the sluggish giant.

It loves its freedom, it hates to enter into combination, the chemists call it inert. You breathe it into your lungs along with the oxygen that reddens your blood—four times as much of it as of the oxygen. But the oxygen unites with the living blood, the lazy nitrogen is breathed out again unchanged. When the oxygen in a closed jar or sealed room is used up, fire cannot burn in the remaining nitrogen, and plants and animals would be suffocated in it.

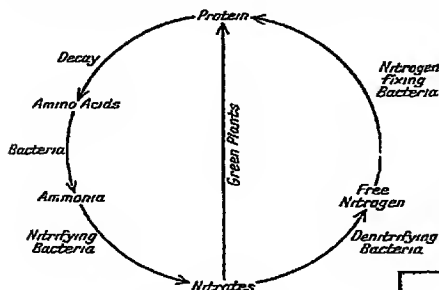
Nitrogen, however, is particular about the company it keeps, it enters into direct combination with only a few of the commoner elements. Here and there other elements have caught a little nitrogen and coaxed it into uniting with them. Because nitrogen does not like society very much, there is little combined or fixed nitrogen on the earth in comparison with the great floods of free nitrogen which bathe our planet. This small quantity of fixed nitrogen we may call nitrogen the dwarf.

Cautiously enough, the combinations which contain fixed nitrogen are generally very active. They break up easily, because nitrogen, you know, hates to be tied down. These are the compounds which chemists call labile or unstable. Some of them break up with great violence. You might imagine that nitrogen (like some persons who are good-natured enough so long as they are left alone) becomes very irritable when forced into company it does not like, and does not care what it does to get away. Some of these easily and violently breakable compounds of nitrogen enter into our high explosives like gunpowder, gun-cotton, dynamite, nitro-glycerine and trinitrotoluene (T N T).

In its free state nitrogen does not support life, in many of its combinations it is an enemy to life. Yet without it life, from the lowliest to the highest forms, could not exist. Every living

NITROGEN

thing, plant or animal, must have nitrogen in its tissues. Where can they get it? Animals must supply all their nitrogen needs through



foods of vegetable or animal origin. That is, all animals obtain their nitrogen finally from plants.

Except for some peculiarly gifted plant organisms, which will be mentioned later, all plants must draw their supply of fixed nitrogen from the soil. The soil obtains some of its nitrogen compounds by the aid of the lightning and the rain. Lightning burns the air in its path, that is, it heats the nitrogen and oxygen until they unite to form oxides of nitrogen. These oxides are washed into the soil by the rain. This is a slow, age-long process.

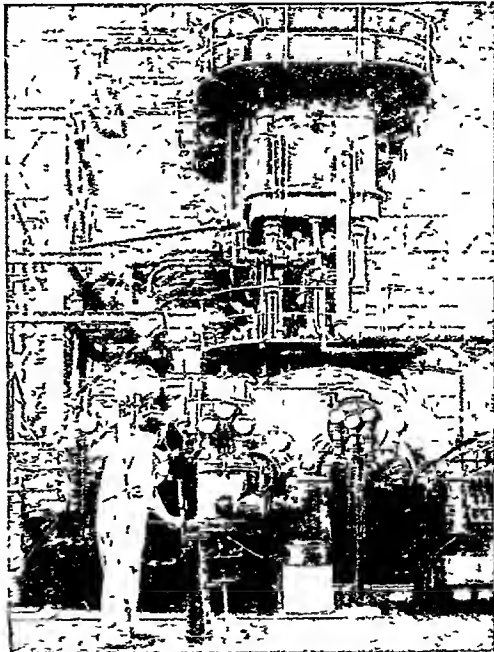
Then, too, there are certain tiny organisms which form an exception to the rule that plants draw their nitrogen from the soil. These nitrogen fixing bacteria live in nodule like colonies on the roots of certain leguminous plants, such as alfalfa, clover, beans, and peas. In return for their lodging, the nitrogen fixing bacteria give to their hosts, the clovers or the alfalfas, or the beans or peas, the nitrogen which they have fixed within their bodies, and the leguminous plants, when they decay, turn their nitrogen compounds into the soil. Thus, soil on which these leguminous crops have been grown is enriched by their decay. Harmful bacteria undo some of this good.

Farmers and planters know that growing certain crops, such as wheat, tobacco, and cotton, too long on the same fields "wears out the land." This is because they take from the soil more of the elements necessary for plant life than they give back to it.

To keep the soil in good condition while growing nitrogen consuming crops, the farmer must either make use of nitrogen containing fertilizers, e.g. guano and in

organic nitrates, or he must "rotate his crops," so that a nitrogen-using crop is followed by a nitrogen-restoring crop.

The fixed nitrogen of the earth is like a fortune which has been slowly heaped up by the painful toil of one generation of owners after another, but which one spendthrift heir can scatter in a few short years. The human race has played the part of the spendthrift heir. Human beings have long wasted the precious fixed nitrogen like prodigals. Untold amounts of the nitrogen containing animal wastes have been and are being allowed to escape into the sea in sewage. A single explosion of a modern piece of artillery, it has been said, frees the nitrogen which it has taken millions of bacteria ages to accumulate. Therefore, it is most important that these wastes



FIXING NITROGEN FROM THE AIR

The diagram at the top of this page shows the circulation of nitrogen as we have been able to trace it. Animal proteins decay, forming amino-acids, which bacteria break down into ammonia. Then nitrifying bacteria make this into nitrates from which plants manufacture proteins. The other half of this cycle is described in the text. The complicated apparatus seen in the photograph synthesizes from air and water huge quantities of ammonia, which is made into fertilizer.

Imperial Chemical Industries Ltd.

should be checked before the world begins to starve for lack of nitrogen compounds

Two very cheering facts are these

(1) A way has been discovered of speeding up the plant processes of adding nitrogen to the soil. This is by inoculating the soil on which leguminous plants are to be grown with cultures of nitrifying bacteria.

(2) Inventors have found ways of making nitrogen compounds artificially, direct from the free nitrogen of the atmosphere. This, again, is by making use of a natural process, speeded up to meet Man's needs.

Instead of waiting for lightning to make nitrogen compounds, here a little, there a little, through millions of years the electric spark is kept busy urging nitrogen into union with some other element. One process produces nitric acid, others, either by the help of catalysts or through the formation and breaking up of intermediate compounds, produce ammonia, still another induces nitrogen to combine with calcium carbide, producing a compound of nitrogen, calcium, and carbon called calcium cyanamide, used as a fertilizer.

The first process for making artificially fixed nitrogen was worked out in the United States and tried at Niagara Falls, but, failing to prove profitable there, received its greatest develop-



UNDERGROUND NITROGEN FACTORY

Here you see the nodules containing nitrogen-fixing bacteria on the rootlet of a scarlet runner bean. The bacteria obtain their food from the plant's own supply, and in return, pass into the plant the complex nitrogenous compounds which they build up. Leguminous crops, such as the vetches, are made to restore the nitrogen content of the soil, by ploughing their roots in.

ment from the immenso water-power facilities that have been made available in Norway.

This is not all of the story that scientists have pieced together about nitrogen since its discovery in 1772 by Daniel Rutherford, of Edinburgh. You must remember that its chemical symbol is N, that it is just a little lighter than pure air, but is over fourteen times heavier than

hydrogen. That it is colourless, odourless, and tasteless you may know for yourself if you will remember that you cannot see or smell or taste it in the air. Nitrogen enters not only into the proteins of foods but also into poisons, particularly the alkaloids, medicines, perfumes, and dyes. One of its commonest compounds is household ammonia. Then, too, there are the anaesthetic nitrous oxide or "laughing gas," and the useful solvent nitric acid (qv).

The volatile yellow liquid, nitrogen trichloride, is violently explosive.

Noah and Noah's Ark
In the early days of human history, according to what we read in the Book of Genesis, God was so displeased with the people he had created that he decided to destroy them. One man only, Noah,



NOAH AND HIS SONS BUILD THE ARK

The story of Noah and his Ark, by which he saved creation from God's anger, is familiar to everyone. In this painting by the great master Raphael, we are shown Noah directing the labours of Ham, Shem, and Japheth in the building of the Ark.

Vatican Museums photo Anderson

NOAH

the son of Lamech, found grace in His eyes So God told Noah to build an ark, and told him what size it should be, and how he was to construct it And when it was ready Noah and his wife, and their three sons, Shem, Ham, and Japhet, with their wives, went into the ark, taking with them two of each kind of animal

Then God made it rain for forty days, until the face of the earth was flooded and all living things were drowned except Noah and the other passengers in the ark "And the waters prevailed upon the earth an hundred and fifty days"

When the waters showed signs of subsiding, Noah sent out first a raven, and then a dove, and when the dove returned with an olive leaf "Noah knew that the waters were abated from off the earth"

When the ark came to rest—upon Mount Ararat, as tradition has it—Noah and his family and the animals of all kinds landed "And God blessed Noah and his sons, and said unto them, Be fruitful and multiply, and replenish the earth" And as a token that He would never again drown the earth in a deluge, God set the rainbow in the sky

Recent archaeological discoveries in Mesopotamia have proved that a great flood occurred about the time Noah is said to have lived Thus at Kish, Sir Leonard Woolley, digging down through the debris of thousands of years came upon a layer, eighteen inches thick, of clean river sand or clay, and then below this again

traces of an earlier civilization which had apparently been submerged by the waters It may be noted, too, that the ancient Babylonians had a "flood story" which resembles in many features that of Genesis, though Noah is called Utnapishtim You can see at the British Museum, in London, the tablets on which this ancient tale is inscribed

Nobel Prizes.

It is a curious fact that Alfred Bernhard Nobel a Swede who died in 1896 worth £1,750,000, invented one of the most deadly of all death-dealing ex-

NORFOLK

plosives—dynamite—yet provided in his will for five annual prizes, one being awarded for the greatest contribution to world peace

These prizes, worth about £8,000 each, have been given since 1901, and, apart from the Peace Prize (deceased upon by a committee elected by the Norwegian Parliament), they are all awarded by the appropriate learned Swedish Academies The other four are for literature, medicine or physiology, chemistry, and physics

Many famous British names figure among those who have received Nobel Prizes These include Kipling, Tagore, W B Yeats, George Bernard Shaw, and John Galsworthy for literature, Sir Austen Chamberlain, Arthur Henderson, and Lord (Robert) Cecil for work in the cause of peace, Sir Ronald Ross and Sir Frederick Banting for medicine, Sir William Ramsay and Lord Rutherford in chemistry, and Lord Rayleigh, Sir Joseph Thomson, and Sir William Bragg in physics Mme Curie was the only individual of either sex who won prizes in two of the prescribed sections—in her case, physics and chemistry

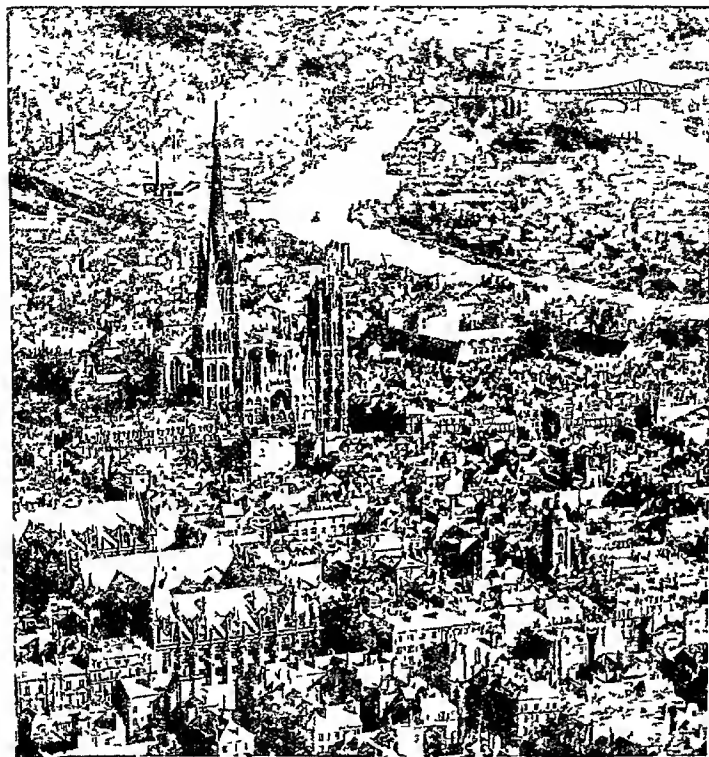
Norfolk, ENGLISH Co Bounded on the north and east by the North Sea and the estuary of the Wash, Norfolk is 2,054 sq miles in area

The surface for the most part is flat, especially the Fen country The western part of the county is drained by the Great Ouse and its tributaries On the eastern side the chief river is the Yare, with its tributaries the Waveney,



SAILING ON THE NORFOLK BROADS

The village of Wroxham, seven miles north-east of Norwich, is one of the chief yachting centres of the Norfolk Broads The broads, or lakes, of Norfolk, together with a few in Suffolk, provide some two hundred miles of navigable waterway, which in summer are crowded with pleasure-craft Wroxham Broad, seen above, covers a total area of 120 acres



ROUEN, CHIEF CITY OF NORMANDY

The large manufacturing town and port of Rouen lies on the Seine between Paris and the coast. It still possesses many fine Gothic buildings and museums of great interest. The 13th-century cathedral, seen in the middle of this aerial view of the city, has beautiful rose windows and fine monuments, and the church of St Ouen is another outstanding example of ecclesiastical architecture. Rouen has often been called "the town of a hundred steeples."

Wensum, and Bure, flowing into the sea at Yarmouth. The tract of shallow fresh-water lakes known as "The Broads" is much frequented for sailing, fishing, and shooting.

Agriculture is the chief industry. Barley, wheat, and oats are important crops, and much mustard is grown. Norfolk is famous for cattle, sheep, and pigs, and large numbers of poultry are raised. The fisheries, both inshore and deep-sea, are important.

Barrows and old entrenchments occur in many places, traces of lake dwellings have been met with, and Roman remains have been found. When the Roman power decayed, the county was colonized by the Angles and formed part of the kingdom of East Anglia. In the 12th

century the manufacture of worsted was introduced by the Flemings.

Norwich (qv) is the county town. Other important towns are (Great) Yarmouth (population, 56,000), a centre of the English herring industry, and King's Lynn. Hunstanton and Cromer are favourite watering-places, and Sandringham House is a royal residence. There are interesting ruined castles at Castle Rising and Castle Acre. The population of the county numbers about 504,000.

Normandy. FRANCE. A country of shimmering streams, of wide spreading orchards of cider apples, brilliant in the spring with white and pink blossoms, a country of wide, straight roads smooth as floors, lined with an endless procession of towering trees, behind which hide trim little farm houses with neat thatched roofs—such is the ancient French province of Normandy, whose curving shores form the middle section of France's northern coast.

It was into this region that the Northmen poured in the 9th century, steering their dragon-proved ships up the wide mouth of the Seine.

It was here in 911 that King Charles the Simple of France did a very wise thing by signing a treaty with their chief Rollo, which gave the Northmen a permanent home on French soil.

In the century and a half that followed, the Northmen leaders became Norman dukes—Christians, French-speaking, and among the most progressive of French lords. From one Norman family five tall sons found their way to southern Italy and began the founding of a Norman kingdom of Naples and Sicily there.

(after 1037) The Dukes of Normandy meanwhile rose in power until one of them, William, crossed the Channel and took possession of England in 1066.

William carried over the germs of many institutions that were later to develop into England's most precious contributions to law and government. But the seat of power was soon transferred across the water, so that it was England that owned Normandy instead of Normandy that owned England. Norman leaders then rebelled and called in the French kings. Disorder and confusion followed until the French king Philip Augustus conquered Normandy from King John of England. The struggle was renewed in the Hundred Years' War (1337-1453), which ended in the expulsion of the English not only from Normandy but from all France, except Calais which remained in English hands for another century.

Separate Abbeys for Men and Women

The centuries of its stirring early history have left their marks on this fair land. In the ancient city of Caen on the river Orne, about ten miles from the Seine Bay, stand two famous abbeys, the Abbey for Men and the Abbey for Women, built by William the Conqueror and his wife Matilda to pacify the Pope, who disapproved of their marriage. Near Caen is placed

little Bayeux, another of the Conqueror's towns, where is kept the famous Bayeux Tapestry (q.v.).

But most famous of all Norman towns is Rouen, the ancient stronghold of the Normans, and the place where Joan of Arc was burned at the stake. Here is a noble Gothic cathedral, in which was entombed the heart of Richard I, Coeur de Lion. Picturesque crooked old streets remain side by side with modern boulevards and fine quays bordering the Seine.

Normandy has some of the finest harbours in France, among them Le Havre at the mouth of the Seine, Cherbourg, at the tip of the great peninsula of Cotentin, and Dieppe in the north-east.

Many of the people of this old province are tall, blue-eyed, and fair-haired, showing their descent from the Normans. They are among the most hardy and industrious inhabitants of France, proud of their ancestry and of their beautiful fertile country. The Normans cling to their old habits and customs. In many parts you may still see the peasants in their old world dress, and the "butterfly" caps of the women of Avranches are famous.

The Channel Islands at one time formed part of the duchy of Normandy, but they remained in the possession of England when Normandy itself was incorporated in France.

The NEW WORLD of the WEST

When Columbus chanced upon the West Indies off the coast of North America, no one realized what a world had been brought to light—a continent that was to become the richest of the world.

North America. When we look back upon the history of North America we cannot but wonder what qualities this continent possessed that caused it so far to surpass the other "new" worlds in the race for people and wealth and power. In the short space of four centuries it has emerged from barbarism, outstripped the centuries old civilization of Asia and northern Africa, and taken its triumphant place alongside Europe as a leader in the world's progress. South America, Africa and Australia shared with North America in Europe's explorations and civilizing influence, but none of these has experienced so marvellous a transformation as North America.

Of all the continents North America was the most hospitable to European influence. It alone opened wide its rivers and harbours to immigration, making it easy for newcomers to reach a hospitable interior. Except Europe, it has the longest coast line in proportion to its size of any of the continents, and it has many excellent harbours on the west coast. It lies largely in the middle latitudes—the region that is pre-eminently "white man's country." There

are no high mountains on the east barring entrance to the interior, the vast central plain stretches unbroken from the Arctic Ocean to the Gulf of Mexico, with an unequalled system of waterways.

The Unbroken Pacific Coast

It was fortunate for America that its discoverers did not come first to the Pacific shore, for there they would have found a more uniform coast and high mountains facing the Pacific in an almost unbroken wall. Except in the north, there are few good harbours, and on the whole coast there are only two rivers valuable for navigation—the Yukon, which opens into the heart of Alaska, and the Columbia, which leads to great mountain systems and an inhospitable country. The only other westward flowing river of importance—the Colorado—drains a large but arid region, its chief gift to mankind still being the scenery of its majestic canon.

Alaska on the west balances Labrador on the east, as Lower California balances Florida, but such great gulfs as Hudson Bay and the Gulf of Mexico are lacking on the Pacific side. If, however, Asiatic nations had been the explorers

of the 15th century, they could have reached the continent without a long sea voyage, either by the stepping-stones of the Aleutian Islands, or by Bering Strait.

Fortunately, in the temperate zone North America is much closer to Europe than to Asia, and its discovery and settlement fell to the lot of Europeans. Columbus came and found the tropical West Indies, the threshold of the New World, smiling a ready welcome. Other Europeans followed, and to them the Gulf of Mexico and the Caribbean Sea gave entrance as the Mediterranean does to Europe, and the rich mines of Mexico led rapidly to Spanish occupation.

Settlers from the more northerly European countries were no less fortunate in their landing-places. Except where the islands of the Arctic Archipelago stretch into an icy sea, all the many indentations of the American coast were friendly to them. As early as 1500 a fishing colony was established on the island of Newfoundland at the mouth of the St. Lawrence, and by that river Cartier and Champlain carried the flag of France far into the heart of the continent.

The Dutch sailed up the Hudson, which is still the chief front door of the U.S.A., and the English found the rivers flowing into Chesapeake Bay in the south and the harbours of New England excellent gates to permanent colonization. All along the fertile coastal plain, which extends from the St. John to the Gulf of Mexico, colonies were established and prospered.

The first check encountered by American expansion was the Appalachian Mountains, which extend in a long and practically unbroken chain from the Gulf of St. Lawrence almost to the present Gulf States. In these civilized days we are not accustomed to think of these moderately high wooded ridges as barriers, but to regard them rather as storehouses of vast wealth in lumber, coal and iron, and other natural resources. In colonial days, however, highways were lacking and this back-country was inhabited by Indians who doggedly resisted.

For 150 years the English colonists were thus hemmed in on the seaboard. Nevertheless,

the nation owes much to the Appalachian barrier. It held together the 13 original colonies when they might otherwise have scattered, and thus promoted the sound growth in strength and population which made possible the winning of the War of Independence, and, after that, the organization of the United States.

French explorers found that the wide St. Lawrence led to the largest bodies of fresh water in the world, the chain of the Great Lakes. Their great size makes them resemble inland seas, and they have a similar effect upon the climate of the region about them. Not only are they invaluable for transport, but they also lend charm to the surrounding country, and give to eastern America its greatest natural wonder—the Niagara Falls. A short journey from the southern shore of Lake Michigan brought the French explorers to the Illinois river, this carried them down to the mighty Mississippi, which the Indians called the "Father of Waters."

Whether we consider its drainage area, volume, length,

or navigability, we must grant that this is one of the great natural features of the world. The Missouri and Mississippi together form an enormous river system affording inland navigation for more than 14,000 miles, and draining an area of 1,240,000 square miles.

Nowhere else does a single river give access to such valuable agricultural territory. From the Arctic Ocean to the Gulf of Mexico one may travel without passing any elevation of more than 1,000 feet above sea-level, for in the middle of the continent the river valley merges with the Great Lakes plain, which, farther north, blends with the valley of the Mackenzie river, flowing to the Arctic Ocean.

After sweeping over the central plain, the pioneers found themselves confronted by broad plateaux, crested by the many high ranges which are known collectively as the Cordilleras. These chains enter the continent in Alaska, broadening as they pass through Canada, and attaining their greatest width in the United States, where the great table-land is in some places 1,000 miles in breadth. All of Mexico except a narrow

Extent—North to south, about 4,500 miles, east to west, 3,000 miles. Area, about 8,578,000 square miles. Peninsulas Alaska, Labrador, Nova Scotia, Florida, Yucatan, Lower California. Population, 163,178,000.

Mountains—On the east the Appalachian System—White and Green Mountains, Adirondacks, Blue Ridge (highest peak, Mt. Mitchell, 6,684 feet). On the west the Cordilleran System—Rocky Mountains (highest peak, Mt. Logan, 19,850 feet), Alaskan Mountains (highest peak, Mt. McKinley, 28,300 feet, the highest on the continent), Cascade Range (highest peak, Mt. Rainier, 14,448 feet), Sierra Nevada (highest peak, Mt. Whitney, 14,496 feet), Sierra Madre (highest peak, Mt. Orizaba, 18,700 feet), Coast Range.

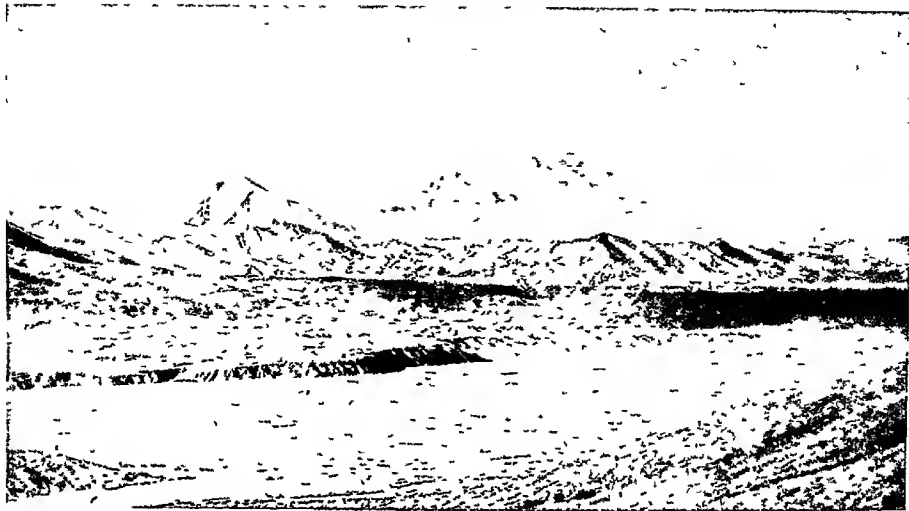
Rivers and Lakes—Rivers: Mississippi-Missouri (4,220 miles), Mackenzie (2,400), Yukon (2,100), St. Lawrence (2,000), Nelson (1,800), Rio Grande (1,650), Columbia (1,270), Colorado (1,050). Lakes: Great Lakes (Superior, Michigan, Huron, Erie, Ontario), Great Bear, Winnipeg, Great Slave, Nicaragua, Great Salt.

Political Divisions—United States (including Alaska, Panama Canal Zone, and Puerto Rico), 3,685,000 square miles; Canada, 3,664,000 square miles; Mexico, 767,000 square miles; Central American States (Guatemala, Honduras, Nicaragua, Salvador, Costa Rica, and Panama), Cuba, Haiti, Dominican Republic. British possessions (excluding Canada), Newfoundland and Labrador, Bahamas, Bermuda, Jamaica, British Honduras, Danish colony, Greenland.

JOURNEY THAT LED TO FOUNDING OF QUEBEC



Champlain's most important expedition had for its object the exploration of the interior of Canada. He ascended the mighty St. Lawrence, and on July 3, 1608, disembarked on the site of Quebec, where he began to establish a settlement by building a fort and residences, and laying out fields and gardens after much hard work in clearing the ground



Dorcen T. 1914

TWO OF THE HIGHEST MOUNTAINS IN NORTH AMERICA

Above are seen the cloud-ensheathed peaks of Mt McKinley (20,300 feet) and Mt Foraker (17,000 feet), seen from Wonder Lake. Mt McKinley is the highest mountain in North America, and is situated in the Mt McKinley National Park, Alaska, second largest of the national parks of the United States. These mountains form part of the Alaska Range. Mt McKinley is locally known by the native name of Denali. Note the glacial moraine in the foreground.

coastal plain is a part of this vast plateau but there the mountains are lower on the whole, and the rainfall is greater. In southern Mexico occurs a break in the long system, known as the Isthmus of Tehuantepec, but in Central America the mountains rise again, fringing the western coast.

Thus Cordilleran region is the scenic wonderland of America. In Alaska are glaciers more marvellous than those of the Alps, and Mount McKinley, the highest peak on the continent, raises its head almost 5,000 feet higher than Mont Blanc, highest peak in western Europe.

Magnificent Creations of Nature

The Cascades and Sierra Nevadas, which lie near the coast of Canada and the United States, present some of the most magnificent mountain scenery in the world, and in the Rocky Mountains is a region of geysers and hot springs, part of which is preserved for visitors in Yellowstone National Park. Farther south lies the "Dead Sea" of America—the Great Salt Lake, and still farther southward, the Grand Canyon of the Colorado river.

From Alaska down to the Isthmus of Panama the Cordilleras contain rich veins of gold, silver, lead, and copper. No navigable streams lead to the region except the Missouri, and even it will only take one within several hundred miles

of the mountain wall. Moreover, the plain country which leads to the mountains is so dry that it did not tempt farmers from the well-watered central valley, and at several places in the central basin are great cactus-covered deserts. But as gold had lured men into the mountains of Mexico, so it has lured them to the Pacific shore of the United States and Canada, and later to Alaska, and so potent was the charm that in less than half the time it took to conquer the Appalachians, men had crossed deserts and mountains and established their settlements on the far-distant Pacific slope.

When Man had finally penetrated every corner of this continent, he found few places which could not contribute something to his needs. The only considerable exception is the extremely cold north, where the numerous icy islands of the Arctic Archipelago stretch away to a point only 450 miles from the North Pole. In these low regions there is little vegetation, and hardly any animal life except in the sea, from which the Eskimos derive their sole support. On the whole, it has been estimated that the barren lands of North America, including the few desert regions, comprise only two per cent of its entire area.

Large areas in northern Canada and Alaska, in addition to the vast Rocky Mountain and

THE VARIED ANIMAL LIFE OF NORTH AMERICA



Here is a selection from the many wild animals found in the continent of North America 1, the puma or 'mountain lion', 2, the wapiti 3 the common black bear, 4 a pair of quaint raccoons 5 the beaver Nature's most wonderful builder and architect. Although as in other lands which Man has invaded these creatures are not so common as they used to be, they are now preserved in the great National Parks of Canada and the United States



Photos 1. Daily Mirror 2 H. J. Steptone 3 L. Matthews

Appalachian regions (in all, one-fifth of the continent), are covered with valuable forests. The semi-arid regions of the west (comprising one-fourth of the entire continent) are at least suitable for grazing. Approximately half of North America is excellent for agriculture, and this proportion is steadily being increased by dry farming and the irrigation of lands which formerly were thought useful only for grazing.

Vegetable and Mineral Wealth

Although North America contains less than one-tenth of the earth's people, it is a land of enormous wealth. It furnishes one-third of the entire world's supply of wheat, two-thirds of its cotton crop, and three-fourths of its maize. Of the precious metals it contributes about one-fourth of the gold and almost two-thirds of the silver of the world, and in the so-called "basal"—though really more valuable—metals, its supply is unexcelled. Of iron, North America produces almost one-half of the world's supply. Its coal deposits are richer than those of any other continent, with the possible exception of Asia, and they furnish over a quarter of the world's coal production. North America also contributes almost three-fourths of the petroleum, and an equal proportion of copper.

Like other continents, North America consists of a broad fold of the earth's crust, only a part of which rises above the level of the sea. In very ancient times, when this uprising fold first emerged above the surface of the waters, it did not appear as a single united land. The tops of the mountains arrived first, making groups of islands of varied size, like the West Indies. We do not know just where the first peaks were, but it seems clear that they included the Appalachian Mountains in the U S A and the Laurentian Mountains in Canada, and that these first upheavals were followed much later by the Cordilleras. Until comparatively recent geological times the Mississippi valley was entirely under water, forming a sea that extended from what is now the Gulf of Mexico all the way to the Arctic Ocean.

Last Stage of the Continent's Growth

Gradually, because of the rising of the original islands or the receding of the ocean, the "Mississippi Sea" became more shallow. Wind and rain cut down the mountains, and the sediment which the rivers carried from them filled up this inner sea, forming the deltas and flood plains which are now among the most fertile lands of the country. Finally, the various archipelagoes were united into one great land.

Ages after the first emergence, when the climate was warmer and wetter than it is now, occurred what is called the Coal Period. Extensive swamps filled with tall fern-like growths covered much of the continent like a tropical jungle, extending as far north as the Arctic

Circle. The land was still in an unstable condition, and after these forests had grown a few hundreds of years, the plains sank beneath the sea, and layers of mud, sand, and gravel collected over them. In time these layers became solid rock and the vegetation beneath was changed to coal. Then the land rose again and new forests grew, causing one layer of coal to be formed over another. All this time, and at other periods, deposits of iron, copper, gold, and silver were also being laid down. Many minerals were brought by hot water and deposited in cracks in the mountain rock, where they hardened, forming "veins."

In more recent geological times the climate for some reason became much colder, just as in the Coal Period it was much warmer. A vast sheet of ice appeared in the north, and crept slowly southward, covering a large part of Alaska and Canada, and about one-third of the United States. Thousands of years were required for its slow advance, and thousands more for its disappearance, much of the continent is still really in the Ice Age, since remnants of the ice-cap still cover the greater part of Greenland and parts of Arctic North America.

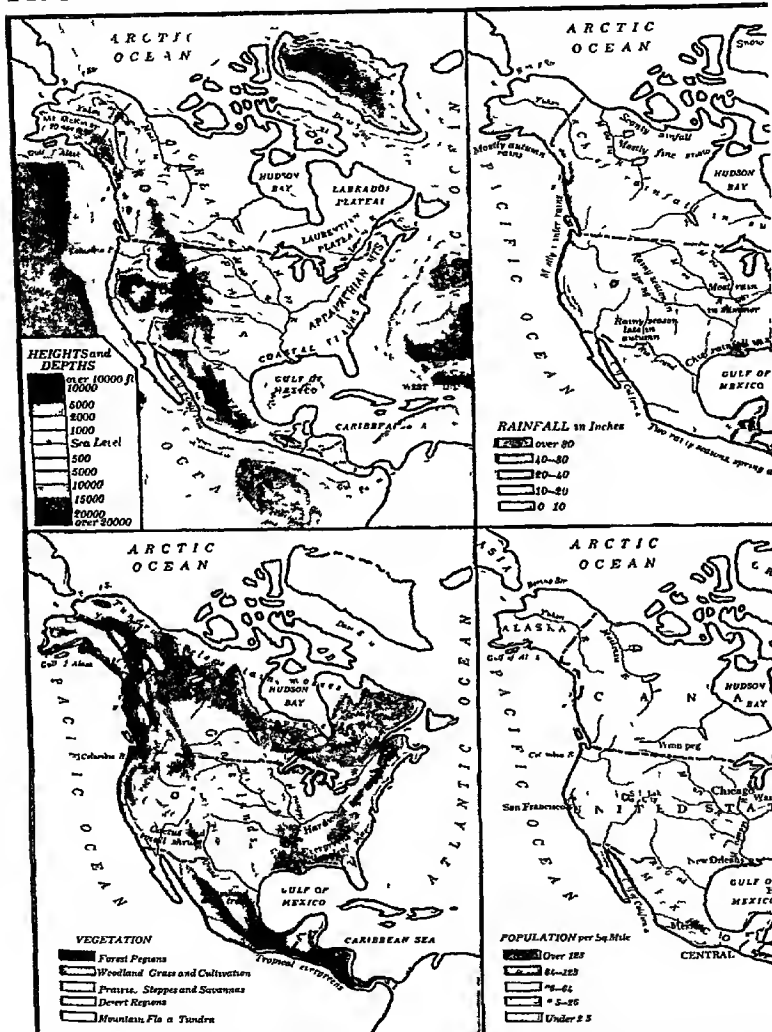
Effects of the Great Ice Sheet

Ice scoured the rocks over which it passed, and swept away the soil that covered the land. It deposited bits of ground-up rock called "drift," which produced a fertile soil in many places, but sometimes it failed to grind up the rock, and thus left boulders and pebbles, which greatly hinder the farmer. Moreover, it blocked up the courses of former rivers, and it dug out and left great hollows, which are now the lakes and ponds of north-eastern North America. Even the Great Lakes we owe largely to this glacial action.

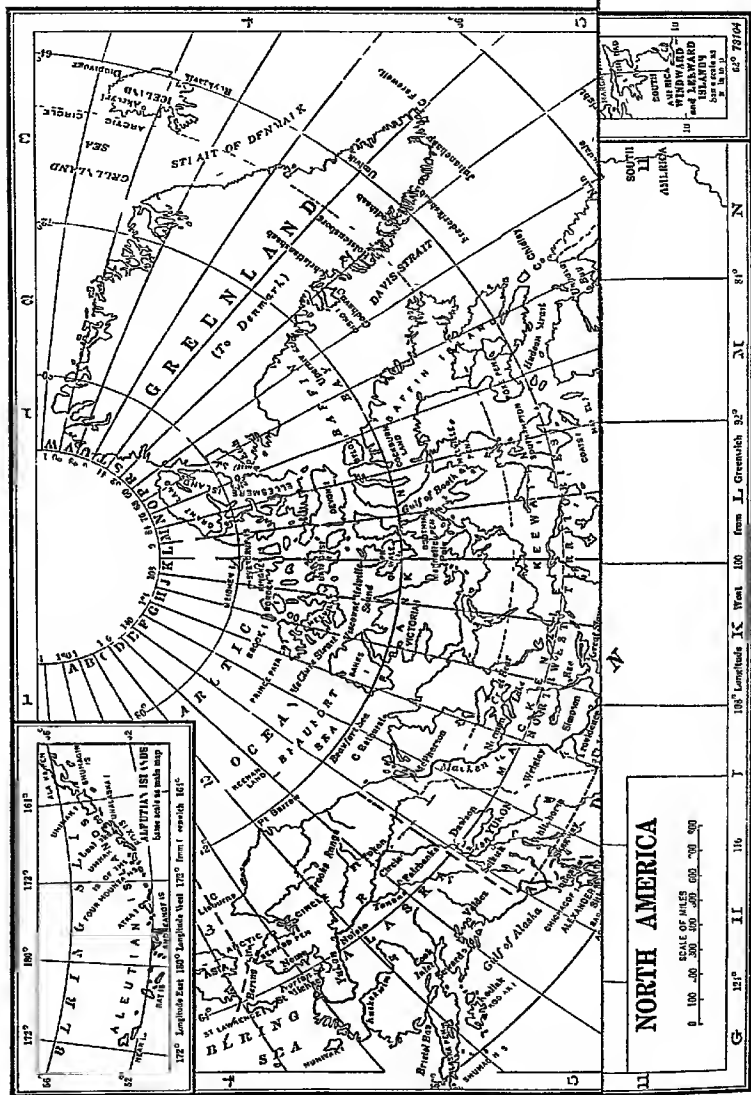
But the most important work of these millions of years—that which was to have most influence on the climate, and, therefore, on the crops—was the forming of the mountain systems. The Laurentian and Appalachian mountains, as stated, rose in very early ages, and since then they have been slowly worn away by weather and water. Being low, they allow winds to carry much moisture over them. The Cordilleras are younger than the more eastern mountains, and considerably higher. They are, in fact, still growing, as is seen by the earthquakes caused now and again when they crack under the enormous strain. When winds from the west reach these lofty mountain ranges, they are forced to drop much of their moisture, and when they finally reach the eastern side they have little left. This causes the great plains and plateaux of the western regions to be dry or arid.

Of great importance in its effect on commerce is the fact that the coast of North America is

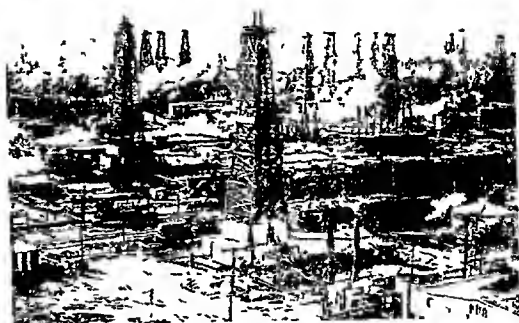
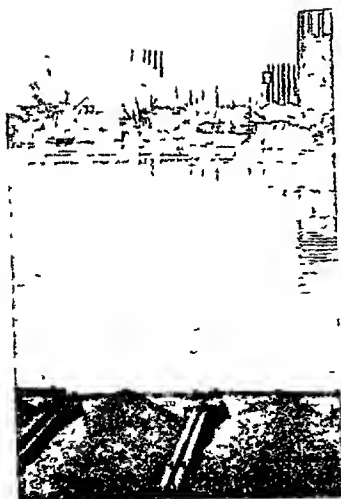
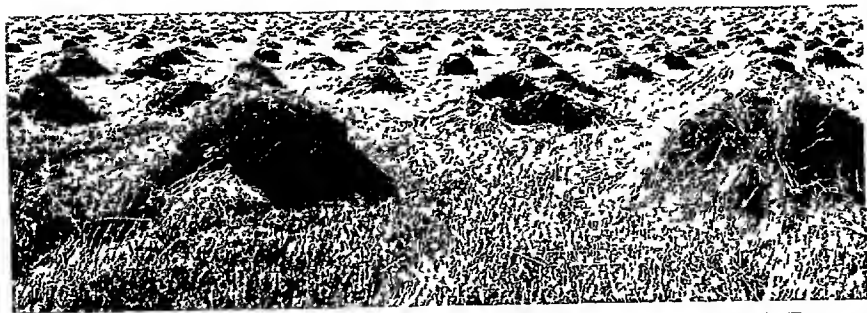
FACTS YOU SHOULD KNOW ABOUT NORTH



As if the very mountains themselves had anticipated the spirit of the pioneers we find the old worn-down ran young lofty mountains in the west. In the upper map on the right you can pick out the well-watered region shu off by mountain barriers from the moisture-laden sea winds. The maps below strikingly show how the different regions and the relative density of population are in large part determined by these natural concentration of population is as you see about the sea coasts and the Great Lakes and Mississippi



NORTH AMERICA'S GIFTS TO THE WORLD'S WEALTH



Here we see how some of the great natural wealth of North America is produced: 1, stooked wheat on a farm in Alberta, 2, coal products plant at Pittsburgh, 3, an oil field in Texas, 4, mechanical cotton picker on a Louisiana plantation

Photos Canadian Official Keystone Dorina Letch



slowly sinking in the north and rising in the south. A sinking coast allows the ocean to enter the lowlands, leaving the higher land to form peninsulas and islands, while the valleys make bays and inlets. Thus on the Pacific coast, north of Seattle, we find a very ragged outline, in the Arctic north are great islands and peninsulas, and on the Atlantic seaboard is a very irregular coast as far south as New York. These indentations have given rise to many important cities on the Atlantic coast, because of the excellent harbours which the submerged river valleys have made.

But south of New York and Seattle the dominating movement of recent times has been upward. A large part of the Southern states, bordering on the Atlantic and the Gulf of Mexico, was once part of the ocean bottom or "continental shelf." This shelf is still rising, with the result that there are few good natural harbours on the Atlantic coast below New York, and, with the exception of San Diego, none below San Francisco on the Pacific (See Canada, United States, etc.)

Northamptonshire, ENGLISH CO. This inland county (called Northants for short) is situated to the north of Oxfordshire. It is 998 square miles in area, with a population of about 361,000.

The north-eastern part is low and flat, being fen country, but elsewhere the land is undulating. Formerly there were many forests, as is shown by the names of some of the districts—Roelingham Forest and Yardley Chase. The Welland, the Nene, and the Avon are the chief rivers, and other waterways include the Grand Union Canal. Wheat, barley, and oats are grown, and stock-raising and dairying are now increasingly important.

Roman remains have been found at Castor, Ickhester, and elsewhere, and the two great Roman roads, Watling Street and Ermine Street, traverse the county. The cathedral at Peterborough (population, 43,000) is a magnificent building. The chief industries of this city are the manufacture of railway rolling stock and agricultural implements.

The district round Peterborough is known as the Soke of Peterborough, and is a separate county for administrative purposes. "Soke" is an old word which meant the right to hold a court of law, and then came to be applied to a district which possessed such a right.

Northampton (population, 92,000), the county town, on the Nene, is the chief centre of the English boot and shoe industry. Other places of interest are Kettering (population, 31,000), Daventry, where the Empire broadcasting station is situated, Naseby, where King Charles I was defeated in battle by the Parliamentarians in 1645, Oundle, famous for its

public school, and Pytchley, home of Northamptonshire's best known hunt.

Northcliffe, ALFRED HARMSWORTH, VISCOUNT (1865-1922). The newspaper which is popped through your letter-box in the morning or which you buy in the evening from the shouting paper-boy, is very largely the creation of one man. But for Lord Northcliffe, it would have been far less bright in appearance, and without many of the features which nowadays we have come to expect in every newspaper worthy of the name.

Alfred Harmsworth was born at Chapelrod, Dublin, on July 15, 1865, the eldest of the seven sons of a barrister-at-law. His first venture into journalism was in 1878, when as a boy of thirteen he started a school magazine at Henley House School, Hampstead. Two years later he received his first paid appointment as a journalist, and when 17 was made assistant editor of "Youth." From 1885 to 1887 he was on the staff of the publishing house of Cliffe & Sons at Coventry. Then, returning to London, he started his first paper, the weekly journal "Answers."

Harmsworth realized that the Education Act of 1870 had created a vast new reading public. Millions of people whose fathers and grandfathers had never had any education—perhaps could not even read—were now being turned out by the "board schools" into a world where most of the reading matter was decidedly "highbrow." Nearly all the books were written by educated men for educated men, the newspapers were extremely "stodgy" and concerned almost entirely with questions of politics and literature. Now, Harmsworth, having had a very limited schooling himself, knew just what the new public wanted. Here, he said to himself, is an army of men, women, and young people who want something to read—something interesting, something lively, something which will give them information without the least suggestion of dullness or the school text-book. And this something is what he set out to supply—and succeeded in supplying in full measure, as the success of his newspapers showed.

"Answers"—its original name, "Answers to Correspondents," helps to explain its popularity in the light of what has just been said—was followed by many other papers that appealed to the man in the street, the woman in the home, the schoolboy and schoolgirl.

Northcliffe's Greatest Achievement

But Harmsworth's greatest achievement was the launching of the "Daily Mail," the first number of which appeared on May 4, 1896. It was the first newspaper to be published at the price of a halfpenny, and it made it possible for hundreds of thousands of those who had hitherto felt that a daily newspaper was beyond

NORTHCLIFFE



their means to have one on their breakfast-tables. The "Daily Mail" gave the day's news as completely as the penny newspapers, but in a much more interesting fashion, and in its editorials it reflected Alfred Harmsworth's own vigorous and independent views. In conducting this great newspaper Lord Northcliffe put a sincere patriotism and strong political convictions before every other consideration, and expressed views that sometimes aroused hostility, but the sincerity of which was never questioned.

After the foundation of the "Daily Mail," Lord Northcliffe became the predominating power in British journalism. In planning the "Daily Mail" he had been guided to a great extent by his experience with the London "Evening News," which he and his brother Harold, afterwards Lord Rothemere, bought in 1894 when it was in a bankrupt condition and soon raised to a high level of prosperity.

In the meantime Lord Northcliffe had joined his weekly and monthly publications together in the gigantic business of the present Amalgamated Press. In 1903 he founded the "Daily Mirror"—the first "picture paper"—and at the outbreak of the World War, in 1914, he controlled "The Times," the "Daily Mail," the "Evening News," the "Weekly Dispatch,"

the "Overseas Mail," and the "Continental Daily Mail," among other papers. Their vast circulation gave him great influence, and he showed characteristic courage and independence in his attitude towards the events of the War, criticizing when he felt criticism was deserved, but using his power to hearten public opinion and to discourage a defeatist spirit.

Towards the close of the War Lord Northcliffe—he was made a baron in 1905 and a viscount in 1917—rendered his country a service of inestimable value when he accepted the post of Director of Propaganda in Enemy Countries offered him by Mr. Lloyd George. With an astounding insight into German psychology and with equally remarkable ingenuity in distributing to the enemy countries information about the true state of affairs, he did much to contribute to the collapse of the Central Powers. General Ludendorff, indeed, described him as "a master of mass suggestion," and after the Armistice Mr. Lloyd George, in expressing his



LORD NORTHCLIFFE OF THE 'DAILY MAIL'

The great newspaper owner (top) always showed wonderful foresight, and this was never demonstrated more clearly than by his belief in the future of aviation, for he offered several £10,000 prizes for pioneer flights. In the lower picture he is seen talking with Mr. Winston Churchill (left) at an aviation meeting at Hendon in 1911.

thanks, stated that he had "many duet evidences of the success of your invaluable work."

Lord Northcliffe was always deeply interested in the great adventures of mankind. In the early years of his success he financed the Jackson-Harmsworth Polar Expedition, and when he first saw Wilbur Wright fly in France

in 1908 he recognized that there was a great future in the aeroplane and by the offer, through the "Daily Mail," of large money prizes for big flights did much to encourage aviation. After the War Lord Northcliffe's health began to fail, and he died on August 14, 1922. In 1887 he married Mary Elizabeth Milner, but left no children, and the title became extinct.

WHEN THE VIKINGS WENT A-ROVING

No country in Europe was free from the onslaughts of the "hurricane of the north," for the Norse warriors swept over the continent as far south as Sicily and as far east as Russia

Northmen. In their long, shallow, black boats, the sides hung with round shields, yellow and black, with striped sails and with high curved prows carved in the form of a snake or dragon, the bold Vikings of the north once scoured the sea seeking for adventure, plunder, commerce, and conquest.



The Northmen, whom we commonly call Vikings, were the ancestors of the modern Swedes, Norwegians, and Danes. The long coast-line and many fjords of the Scandina-

vian peninsula on which they dwelt made it natural for them to become sailors. They took to the sea both to catch fish and to make long trading and raiding expeditions to the lands of the north, east, and west. For nearly three centuries—the 9th, 10th, and 11th—their stout boats, driven by sails and oars, ravaged the coasts of Europe from the British Isles and France in the north to Italy in the south. They even rowed up the rivers into the heart of France and Germany. Their invasions were the last wave of the Teutonic conquests which began with the Goths and the Vandals five centuries earlier and overran all Europe.

Wherever they went they spread destruction and terror. So feared were their raids that a special prayer was offered in the churches against them. "From the fury of the Northmen, good Lord, deliver us."

How these Viking chieftains must have loved their roving life on the stormy sea! They even chose their beloved ships as their tombs. Sometimes they were cast adrift, on "the pathway of the swan," but at other times the ship was buried in a "barrow" or long grave mound. At Gokstad, in southern Norway, a Viking ship has been found with the body of its chieftain,

and around him his horses, his dogs, and even a peacock. Only the weapons remained of the treasure horde that had been placed in the ship. Arabian coins of the 9th and 10th centuries, coins from England and Germany, weapons and gold ornaments, saddles and silks from Oriental countries, have been found in the barrows around Birka and Visby in Sweden, telling us of the Northmen's ways of living and their journeyings to foreign lands.

Runic stones with pictures and runic writing also have preserved for us descriptions of the life and wanderings of the Vikings. One such stone in Sweden tells how Sird raised it to her husband Sven, who "often sailed with costly ships to Sengallen (Russia)." Five different runic stones remain to tell us that Jarlabanki, a rich farmer, owned the whole of Taby, a parish still existing in Sweden. One Viking left the story of his life in an inscription on a marble lion at Athens, which now stands in Venice. In this Norse runic language the alphabet had only sixteen letters; it was much like the early Gothic of the primitive Germanic tribes.

Viking History Told in Song

Skalds, or minstrels, sang of the exploits of Viking chieftains and kings during the long winter evenings before the guests and retainers of the chieftains. Sagas based on the songs of the skalds were written in the 12th and 13th centuries, thus keeping for us more knowledge of Viking life. The Eddas tell the stories of the gods of the Northland (*See Odin, Scandinavia, Thor*).

At the beginning of the Viking period, about 850, a number of walled trading towns were already flourishing: Upsala, Birka, and Sigtuna in Sweden; Visby on the island of Gotland; Skiringssal in Norway; Schleswig or Hedeby in Jutland; and Dorstadt in Friesland.

The oaken boats of the Vikings swarmed in the many harbours. Their greatest joy was to plough the stormy waves in search of new lands, from which they could take booty and tribute (*dane-geld*). Their religion taught them that only in a violent death could a warrior hope to ride to Valhalla on the horse of a Valkyrie.

NORTHMEN

As early as A.D. 700 numbers of Norsemen and Danes were migrating to the Orkneys, the Shetlands, and the Hebrides, and to the more distant Faroes. About 800, Danes established trading posts which became the first cities in Ireland, and fifty years later Olaf the White of Norway contested their monopoly. From the islands came raids on Scotland and England.

After Alfred the Great defeated the Danes many settled in East Anglia and Northumbria and for a time ruled a large territory called the Danelaw. (See Alfred the Great, Canute, etc.) Three times Paris fell before the invaders. At last in 911 Charles the Simple, King of France, concluded a peace with Rolf (or Rollo), the leader of the Northmen. By it the Northmen were allowed to settle in a rich section of northern France on both sides of the mouth of the river Seine and Rolf became a vassal of the French king. The name Normandy was given to the district, and the Northmen who lived there were called Normans (see Normandy). Between 872 and 930 many jarls left Norway for Ireland rather than bow to the yoke of King Harold Haarfager.

About a century later Eric the Red established a colony in Greenland. Not many years later according to the sagas his son Leif Ericsson was driven from his course on the way to Greenland to a land of maple trees, self-sown wheat, and wild grapes. This land,

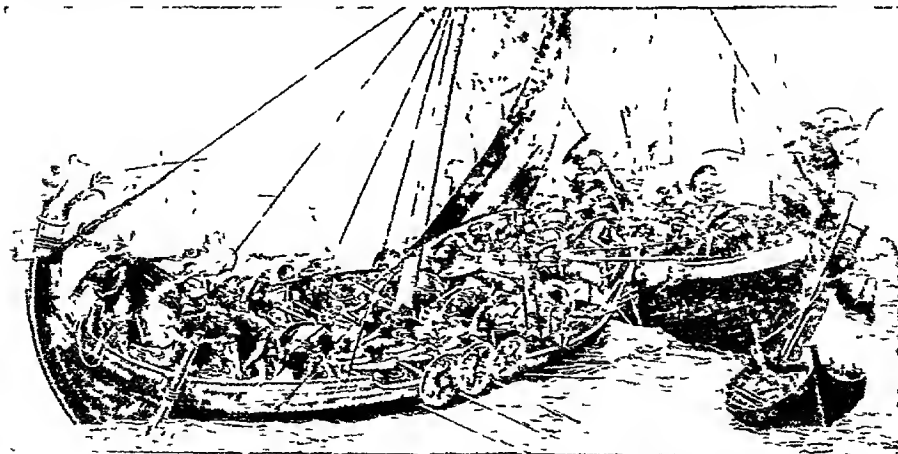
discovered in 1000 he called Vinland, scholars think it was the coast of Nova Scotia, or New England. Two years later Thorfinn Karlsefni with three ships and 180 men and women attempted to found a colony there but they were driven off by the Indians.

Shortly before the settling of Iceland Rurik, with his warriors (*russmen*) came from Sweden to settle along the river Dnieper and gave the country the name "Russia." The kingdom lasted seven centuries.

Christianity everywhere prevailed over the heathen gods by 1050, and the Vikings, as Norman knights, became Crusaders. Under Robert Guiscard, they formed the kingdom of the Two Sicilies.

Just when the Scandinavian peninsula became populated we do not know, but graves of people living in a stone age and in a bronze age prove that civilizations much earlier than the Viking had existed there. First comings of the Anglo-Saxons who came from the region just south of the Jutland peninsula, the Scandinavians belong to the Low German tribes.

Forests covered the homeland of the Vikings. Along the many rivers and lakes along the coast and on the shores of the fiords were clearings burnt in the timber where strips of hirtle grew oats and wheat waved in the breeze. In the centre of the tiny fields stood the village of ten to fifteen houses. Around the houses were



WHEN THE FIERCE NORTHMEN WENT TO WAR

In their long, shallow black boats with high curved prows shaped into snakes and dragons the bold Vikings of the north sailed the known and unknown seas in search of adventure, conquest and booty. At times also they fell out among themselves as in the scene pictured here. War was one of the delights of life to the Northmen. The only thing he dreaded was that he might die at home of some sickness instead of in the excitement of battle.

barns, granaries, separate kitchens, and spinning houses. Just beyond the village was the common meadow which furnished hay for the winter. On the slopes of the neighbouring mountains were meadows where the dairymaids herded the cows in the summer and made butter and cheese. Horses grazed in these meadows, swine grew fat on the acorns of the forest.

Some of these farms and villages have continued in the same family down to the present day. Family pride demanded that land should never go out of the family, it usually descended to the eldest son, and the other sons had to seek their fortunes elsewhere.

In the Edda song "Rigsthula" we find a description of a freeholder during the Viking age. When Heimdal came to visit him, he was

service in battle, they were given land and became wealthy.

In the story "Rigsthula," mentioned above, Heimdal found Jari twisting stings of bent elm, and shafting arrows. His wife wore a headress, a brooch on her breast, and a long trailing gown of blue. Jari's hair was fair, his cheeks bright, and his eyes as keen as a snake's. He ruled over eighteen farms and gave to all treasures and rings (used as money).

But the jarls stood no higher than the kauls in the village councils, nor was there much difference between them when it came to farming, for even the kings personally managed their fields. Thus in 1014 we find King Sigurd Svi of Ringerike in Norway out in the fields, when his famous stepson, Olaf Haraldsson (St. Olaf),



VIKING SHIP AND A FIGURE-HEAD

Above is the old Viking ship, as found in 1903 at Oseberg, Norway, and now (restored) in Oslo Museum. In it some Norse warrior was buried, the whole being covered over with a great mound of earth. On the right is seen what is believed to be the only survivor of the animal-headed carvings which adorned such ships, either as figure-heads or stern-posts.

Left: courtesy of the Oslo University right: British Museum



cutting a loom-beam, his beard was trimmed, his hair lay on his forehead, and he wore a tight shirt. There was a treasure chest on the floor. His wife twirled a distaff, she wore a headress, a smock, a kerchief round her neck, and pin-brooches on her shoulders. She called her child Karl (meaning "man"), and wrapped him in linen. When he grew up, he broke oxen, made ploughs, timbered houses, built barns and carts, and drove the plough. His parents selected his bride, and drove home with "the maiden with the hanging keys and with the goatskin kirtle (coat)." Viking women always carried a bunch of keys, a symbol of their rule over the house.

Slaves, called *thralls*, were captured in battle or bought at slave markets. Most freemen had several thralls, and rich jarls and chieftains had many. The jarls, or "king's men," were warriors or retainers, gathered around the chieftains of the tribes. As reward for special

arrived on an unexpected visit. King Sigurd had "a blue kirtle (blouse-like coat) and blue hose, high boots bound about the legs, a grey cloak and a grey hat, a shade about the face, and in his hand a staff, which had at the top a silver knob overlaid with gold, and in it a ring of silver."

In honour of his noted stepson, King Sigurd put on his best clothes. He had "his boots taken off, and set on his feet hose of cowdam (fine leather), and bound upon them gilded spurs, then he took off his cloak and kirtle, and clad him in gala clothes, and over all a scarlet cloak, and girt about him a decorated sword, and set upon his head a gilded helmet and mounted his horse, which had a gilded saddle."

Meal Time in a Viking Home

Meals were simple even in the homes of chieftains. King Sigurd gave his guests fish and milk every other day, and alternated it with meat and ale. Mead, an intoxicating drink made of honey, was served on festive occasions. All ate with their fingers, and cut their food with the hunting knives that hung at their belts. Before and after meals the women passed basins of water and linen towels. Spoons of wood, horn, or bone were common, and some times they were of silver.

The houses of poor and rich alike were built of logs and differed only in size. A long room with a high-pitched roof was the most important part of the house. In the middle of the hard-beaten clay floor was the open fire, and, above it, a hole

NORTHMAN WHO FOUNDED AN EMPIRE IN RUSSIA



When the Russian tribes of the 9th century found themselves involved in constant quarrels, tradition says that they called upon the Northmen to restore order. In response came Rurik the Oldman, and his two brothers, Sineus and Izygor—all bold sea-rovers. They put an end to Russian disputes by conquering the land from the Gulf of Finland to the Volga, establishing their capital at Novgorod. After Rurik's death in 879, his descendants held princely sway in Russia until the end of the 16th century.

From the painting by H. V. Kozlov.

in the roof to let out the smoke. Windows were cut in the roof and covered with thin transparent skin.

Shields, weapons, and tapestries woven by the women of the household adorned the walls. A place of honour was reserved for the father of the home on the "high-seat" in the middle of one of the long walls, between the benches that lined them. In front of the "high-seat" stood the two "high-seat posts," dedicated to the gods. At night the benches were used for beds. In the better homes beds were built into the walls and covered with rugs and cushions of down. At meals, long narrow tables were set before the benches.

Assemblies of the Village Folk

The village council or *thing*, composed of the freemen decided the village law or *byalag*. Called together at the thing in the *hetað* (hundred), the freemen decided on criminal cases or disputes. If anyone committed murder, he had to pay *weirgeld*, or a fine, to the family of the murdered man, or be outlawed. Gradually, assemblies were developed for all the Scandinavian kingdoms. The Norwegian parliament is still called the *Storting*. In Sweden, the county councils are named *Landsting*.

What contributions did the Northmen make to European civilization? First their merchant vessels and trading towns stimulated commerce between all the regions of Europe which they touched, and helped to break down the isolation of the early Middle Ages. Second, they gave England and France their first fleets, and introduced armour better than any that had been known before. Third, their adventurous and seafaring tendencies quickened the life of the rest of Europe. Fourth, with their genius for government, they influenced the governmental teachings of England and other countries, and they established the first government of Russia. The thousand-year-old parliament of Iceland, the *Althing*, is the oldest existing parliament in the world, and the Isle of Man has a parliament of Norse origin almost as old.

North Sea. The North Sea (once known alternatively as the German Ocean), of which the English Channel is a south-western prolongation, is one of the roughest seas in the world.

Shallow seas are likely to be rough. The average depth of the southern portion is only about 100 feet, towards the middle it reaches 250 feet, and in the north, 400 feet. In places it is shallower still. Indeed, we should have to go back only a few thousand years to find this region dry land, for it was in comparatively late geological times that this sea was formed, when the Atlantic swept over the plains which had joined the British Isles to the mainland.

The Dogger Bank, a great sand-bank 170 miles long by sixty wide in the centre of the sea

between England and Norway, is but fifty to 100 feet under water. The only really deep places are to the north, in the Norway Deep, which sheers off to 1,000 feet twenty miles from shore, and to over 2,400 feet at the entrance to the Skagerrak. This arm, the most notable of the many foid, bay, and estuary formations that indent the shores of the North Sea, separates Norway from Denmark, and connects, through the Kattegat, with the Baltic Sea.

You could lose 180 North Seas and more in the Atlantic Ocean, for its area is only a little over 190,000 square miles, not much more than that of the Caspian Sea. Its greatest length from the Shetlands and the southern coast of Norway to the Strait of Dover is only 600 miles, its greatest width, between East Lothian (in Scotland) and Denmark, is 420 miles, and the distance from Calais to Dover is only twenty-one miles. In the North Sea, particularly on the Dogger Bank, lie some of the richest fishing-grounds in the whole world.

Northumberland, ENGLISH COUNTY Separated on the north from Scotland by the river Tweed and the Cheviot Hills (which rise to 2,676 ft.), this county, with an area of 2,018 square miles, forms the most northerly part of England.

Watered by the Tyne and its tributaries, and the Tweed, Blyth, and several other streams, Northumberland is famed for its cattle, sheep, and horses, and an extensive trade in coal, mined in many parts of the county, is carried on. The salmon fisheries of the Tyne and Tweed have long been celebrated, and agriculture is a leading industry. To the east Northumberland has a very long and important coastline on the North Sea. From here the land rises to the Cheviots, which cover much of the county.

Many battles have been fought in Northumberland, notably Otterburn, a Scottish victory of 1388, and Flodden, where the English under the Earl of Surrey crushed King James IV of Scotland in 1513.

Alnwick, on the river Aln, is the county town and has a population of 6,800. Newcastle-on-Tyne (*qv*) is the largest town in the county. The largest towns away from the Tyne are Berwick-upon-Tweed (*qv*), Blyth (population, 32,000), and Morpeth (7,000). The population of the county is about 756,000.

Opposite Bamburgh, a coastal village with an historic castle founded in the sixth century, are the Farne Islands, famous as a haunt of seabirds. To the north of the Farne Islands, two miles from the coast, is Holy Island, or Lindisfarne. Here St Aidan founded a monastery in the year 635. There are remains of a Benedictine priory church (1093), St Mary's church (1130), and a 16th century castle on the



NORTHUMBERLAND'S PROTECTION AGAINST THE BARBARIANS

Both England's frontiers were the site of great protective works in early times, the Welsh border having Offa's Dyke—a great ditch and earthwork—and the Scottish Hadrian's Wall. Running through Northumberland from the Tyne westwards to the Solway, the latter was built about A.D. 125 by the Romans (see illustration in page 658). Part of it is seen in this picture looking westwards towards Housesteads, a mile castle, seen in the middle distance. The wall was eight feet broad and twelve or fourteen feet high and had castles at every mile.

Photo Gibson

island. Another ancient relic in Northumberland is a long stretch of Hadrian's Wall, which ends at the town of Wallsend.

The literature of Northumberland is largely contained in the stirring Border ballads.

North-West Frontier Province, India. Incessant watch is kept by the British Army and the Royal Air Force on this region, in very truth an outpost of Empire. Were it not for this patrol—a high, particularly in the tribal areas like Waziristan, has a very arduous job on hand in preserving the peace—the way would be open for any enemy from north or west to sweep down on the rich plains of the Indian Empire.

Originally part of the Punjab, but now a full Governor's Province, 39,310 sq. miles in extent, the N.W.F.P. consists largely of tribal areas. In the British territory (one-third of the Province) is Peshawar (with 121,000 inhabitants), the capital of the Province, and leading due west through the mountains towards Kabul in Afghanistan is the famous Khyber Pass. There is a railway right up to the frontier here. The eastern (Punjab) boundary is formed by the Indus, many tributaries of which water the Province. Extensive trade is carried on in wheat, barley, and other cereals. The population of the British territory is given as 2,425,000—rather more than half of the total for the Province.

North-West Territories, Canada. About one-third of all Canada is included in the huge wilderness—1,309,000 sq. miles in extent—known as the North-West Territories. This consists of a plain stretching north from the prairie provinces to the Arctic Ocean, and continued by the great group of islands, the northernmost of which extends to within 475 miles of the North Pole.

The entire population is estimated at only about 10,000, mostly Indians, half breeds, and Eskimos. There are no towns, but a few white people live at the trading posts of the Hudson's Bay Company (qv). The furs of the countless wild animals support the only industry.

Most of the area is still unexplored, and must remain uninhabitable for white men because of the severity of the climate. About half comprises the great treeless plain known as the Barren Lands. In the west, along the valley of the Mackenzie river, however, the soil is fertile.

Until 1870 all the region was part of the immense possessions of the Hudson's Bay Company. It is now administered by a Commissioner appointed by the Government of Canada, and is divided into three districts—Mackenzie, Keewatin, and Franklin.

Included in the Territories are the Great Bear and Great Slave Lakes, Hudson Bay, and the enormous Baffin Island.

RUGGED LAND of the MIDNIGHT SUN

Ocean-girded Norway is a place of great natural beauty, and a romantic land with a long and fascinating history. This article gives us the opportunity to tour the country without moving from our own firesides

Norway. Land of the Midnight Sun, of still summer twilights that last until dawn, of snow-capped mountains, glaciers gliding to the sea, and mountain lakes as clear as crystal, of tumbling waterfalls and rushing rivers, of high pastures with cow-bells tinkling among the precipices, and deep valleys edged with somber pines and glistening birches, of fjords, placid and smiling, or dark and threatening, whose beauty defies

description—such is Norway, land of the Vikings of old, a very paradise for winter sports or summer tramps or cruises.

Norway (in the Norwegian language, *Noige*) is the north-western part of Scandinavia, that great peninsula which appears on the map as a dragon's head stretching out from the mainland into the northern seas of Europe. The dragon's mouth seems partly to open towards the south, where the Skagerrak, an arm of the North Sea, cuts into the land to form two smaller projections, the southernmost parts of Norway on the one hand, and of Sweden on the other.

Extending northward and eastward from here, a great ridge of mountains, chief of which are the Kjolen or Keel mountains, forms a barrier between these twin countries and covers most of the surface of Norway, making it one of the most distinctly mountainous countries in Europe. These highlands, however, are not so much a system of mountain chains as a group of elevated plateaux, grooved by many deep valleys cut during the Ice Age by the overwhelming march of glaciers.

Thousands of Miles of Coast

But even more rugged and irregular than the surface of the land is its coast-line—its cliffs broken by innumerable fjords, and bordered by a fringe of about 150,000 rocky islands. If we were to measure all round these indentations and islands, we should find the coast-line to be about 12,000 miles, long enough to extend nearly half-way round the earth. We might expect to encounter violent storms along such

Extent—South-west to north-east, about 1,100 miles, east to west, 60 to 250 miles. Area, about 125,000 square miles, coast-line, including fjords and islands, about 12,000 miles. Population, about 2,896,000.

Physical Features—Surface a rugged table-land, with numerous isolated mountain masses, snow-fields, and glaciers. Chief ranges: Kjolen (Keel), on border between Norway and Sweden (the highest point, Jaeggvarre, 6,283 feet), Dovre Fjeld (Snehaetta, 7,615 feet), Rjondane Fjeld (Hogronden, 6,929 feet), Jotun Fjeld or Jotunheim (Galdhoppigen, highest mountain in Scandinavia, 8,390 feet). Largest glacier in Europe, Jostedalshrae (area, 580 square miles). Principal fjords: Oslo, Halse Bukken, Hardanger, Sogne, Nord, Trondheim, Geiranger, Vest (West), Lyngen, Varanger. Chief rivers: Glommen, Drammen. Numerous lakes.

Products—Oats, barley, rye, wheat, and potatoes, cattle, sheep, and dairy products, cod, herring, mackerel, and other fish, whale oil, iron, copper, nickel, silver, lumber and timber products, chemical, paper, and food products.

Principal Cities—Oslo, capital (population, about 253,000), Bergen (population, 98,000), Trondheim (population, 54,000), Stavanger (population, 45,000).

a rough coast, but within the *skjaeggard* or "island-fence" the waters are comparatively smooth.

Although Norway extends almost 300 miles into the Arctic zone, and nearly a third of the entire country is in the domain of the Midnight Sun and the winter darkness, the climate on the west tempered by the warm winds from the Atlantic, is far milder than one might expect. Only on the east coast and among the central

mountains is the cold severe. The winters, however, are longer than ours. In the same latitude in which lie the almost uninhabitable Arctic regions of America and of eastern Siberia, the waters of the western fjords, warmed by the Gulf Stream drift, never freeze except in their upper extremities.

If we arrive at Oslo (*g v*) formerly Christiania, the capital and largest city, in February, we shall find the national winter sport of skiing at its height. The hills and mountains about the city, now covered with snow, are the playground for the entire populace, who with their skis or toboggans make their way to the top of Holmenkollen Mountain, to come shooting back at lightning speed over the five-mile course from the very top of the peak down to the foothills.

With the approach of summer we may follow the popular custom of tourists, strap our knapsacks on our backs, and start out on a walking tour through one of the many lovely valleys in central or southern Norway. The roads are excellent, the scenery is ever-changing, and good accommodation is easily obtained.

The valleys are the chief agricultural regions, but they comprise less than four per cent of the total area. The Saetesdaal, in the extreme north, is particularly interesting because, owing to its being far removed from the railway, it is one of the few places in Norway where the inhabitants still cling to their old habits and peasant costumes.

The farmsteads all over Norway are built of timber, and consist of four or more separate

NORWAY AND HER NEIGHBOURS IN SCANDINAVIA



The great Scandinavian peninsula comprises Norway, Sweden and part of Lapland, and the Scandinavian countries include Denmark as well as the other two. The peninsula forms the northern tip of Europe, reaching far up into the Arctic Circle. Notice the saw tooth coast of Norway, the most ragged and broken stretch of seaboard in the world. The map shows how great shoals of food-fish—cod, mackerel, and herring—make their haunts in the cold waters that wash this rock-bound shore.

buildings surrounding an open square. Of these buildings the *stabbur*, or storehouse for food, is picturesque, with a bell-tower, broad overhanging eaves, and with picles at each corner which raise the building several feet off the ground. Frequently the buildings are roofed with birch-bark or with turf, in which grass and flowers and even small trees grow, so that it is not an uncommon sight to see the numble mountain goats grazing on the low steeply pitched roofs. In addition to their lowland farms, most of the farmers possess *sacters* or mountain pastures often one or two days journey distant, where the cattle are sent to graze during the summer months and where the winter supply of cheese principally goat's milk cheese is made.

If we enjoy mountain climbing we shall find ample opportunity to indulge in this sport. The Kjølen mountains, which separate Norway from Sweden extend down wards across the country from the north in many peaks and high plateaux. From the great central valley called the Gudbrandsdal, the courageous are invited by the Dovre mountains to the north or the glittering peaks of the Jostheim to the south. Skirting the valleys are the wonderful forests of pine and fir, the source of one-fourth of Norway's national wealth. The lovely Hardanger plateau in the south-west is the largest mountain plateau in Europe.

As we ascend to the more elevated reaches the evergreens are replaced in turn by birches, dwarf willows, and reindeer moss, and finally we reach the vast regions of perpetual snow and ice. Norway has the most gigantic glaciers in all Europe, one of them covers 580 square miles, is 1,400 to 1,600 feet thick, and thrusts scores of branches, like giant arms, into the neighbouring valleys, and in some cases even into the sea itself.

But of all the wonders and the charms of Norway, none can compare with the majesty and the sublimity of her fjords, those long arms

of the sea extending far inland, sometimes for more than a hundred miles—twisting and turning among the mighty precipitous cliffs of the towering mountains.

If we were to take a summer cruise we should find the countless splendid harbours filled with ships. Doubtless we should visit Stavanger, at the head of the lovely Buiken fiord, quaint old Bergen, the second largest city in Norway, and one of the chief trading-stations of the old

Hanseatic League, and Trondheim, the third city of Norway, the ancient spiritual and intellectual centre of the north, famous for its magnificent Gothic cathedral, the grandest church in all Scandinavia, where the kings of Norway are crowned.

One hundred miles north of the Arctic Circle, we should reach the wonderful Lofoten or Lofod Islands, lifting their steep, jagged, snow-capped peaks 4,000 feet above the sea, their lower levels inhabited by millions of eider ducks, whose down is so valuable. Between two of these the rushing tide, pent up by the island barrier, forms the famous Maelström whirlpool. These five islands are the centre of the Norwegian cod fisheries, which are annually visited during the first three months of the year by a large fleet of fishing vessels.

Near by is Narvik, the terminus of a railway from the Scandinavian peninsula from the Swedish port of Lulea on the Gulf of Bothnia, and one of the two most northerly railway stations in the world. Narvik, noted for its export of iron ore, was the scene of one of the most crucial episodes in the Second World War (See Fact Index).

Two hundred and fifty miles north of the Arctic Circle, where sunset and sunrise meet, is Tromsø, a seaport of 10,000 inhabitants, a busy trading-post for fur and fish. During the long winter night, from the middle of November to the end of January, the city is lighted by electricity—as are all the buoys and lighthouses along Norway's coast.



YOUTH AND AGE IN NORWAY

Weather-beaten indeed is the face of this hardy old Norwegian farm-worker, holding his plaid-clad granddaughter. Norwegians pay no attention to the weather, and do not think to change their clothes after getting wet through.

Photo S. J. Beckett

'STRAY SHOTS' FROM A CAMERA IN NORWAY



These snapshots taken by a tourist in Norway, show goats climbing the steep sides of one of the fine mountain roads, a farmer a high-perched storehouse, a group of farm buildings in the pine-clad hills, and peasants making bread. The countryside of Norway has a clean orderly appearance which reflects the careful industry of the people.

NORWAY

Finally we reach Hammerfest, the northernmost town in the world, built on an island off the Finnmark coast and visited by tourists from all nations who come to view the splendors of the Midnight Sun. For as seen from Hammerfest, the sun does not set from the middle of May to the end of July, and the long summer day is a busy time for this little port.

A Centre of Trade in the Arctic

Great warehouses and hundreds of ships festooned with diving fish line the harbor, the odor of cod-liver oil, the most valuable commodity, pervades the air, whaling expeditions bring in their haul, while Russians and Finns, English Germans, Swedes, and Lapps fill the quays with a picturesque throng, chattering in many tongues. Snow lies on the mountains round about, but the grass is green on the slopes, and wild flowers bloom in every sheltered nook, although Hammerfest is 300 miles north of the Arctic Circle.

Fifty miles north of Hammerfest the coast of Norway and of Europe reaches its farthest point north in the grey barren cliffs of the North Cape, and Spitzbergen (Svalbard), a valuable group of islands placed under the sovereignty of Norway by the Peace Conference in 1919, lies far north in the Arctic Ocean, a two days' journey distant.

This archipelago of five large islands and many small ones has recently become of very

considerable importance because of the immense coal deposits, which are now being worked by British, Norwegian, Russian, and Swedish companies. The other mineral resources, still undeveloped, include iron, copper, and zinc.

Oats is the chief grain produced in Norway, and rye and barley are the chief bread cereals. Wheat, being less hardy than the other grains, is produced in smaller quantities, and only in the southern parts of the country. Potatoes grow easily in almost all of the inhabited districts, and are one of the chief foods.

Cattle and sheep are kept in large numbers. Co-operative dairies have been established, and quantities of butter and cheese are made for export as well as for domestic use. The nomadic Lapps in the far north keep herds of reindeer, which supply them with meat, milk, and hides, and which they also employ as draught animals.

Norway's Wealth of Fish

The forests and fisheries are Norway's chief natural sources of wealth. Fishing is the oldest of Norwegian industries and still remains one of the most important, the value sometimes amounting to more than £9,000,000 in a single year. Norwegian cod, either salted or dried in the form of "stock-fish" and cod-liver oil are shipped to the various European countries and to America. Whales are hunted in the Arctic seas, while every year a numerous fleet of huge



ON PLEASURE BENT IN A NORWEGIAN FIORD

A favourite method of spending the summer holidays is a sea-cruise along the lovely coast of Norway, and this tourist traffic has greatly increased since the Great War. The steamers venture far up the fiords as well as along the coast, and the voyagers can admire some of the finest mountain-and-water scenery in the world. Above is a cruising steamer in the Nordfjord, about midway between Bergen and Christiansund, at rest in still waters in a most beautiful setting.

Photo: Internationale Press Exchanges Ltd

THE OLD AND THE NEW ENRICH LIFE IN NORWAY

MODERN AND SMART is the Grand Hotel, the building with many wings which we see in the picture below of the Eidsvolds Plads in Oslo, capital of Norway. To the right is the quiet old Parliament House with its round central part and two long wings. The city was founded by Harold "the hard ruler" in 1018 not long after daring Vikings proved had touched American shores.

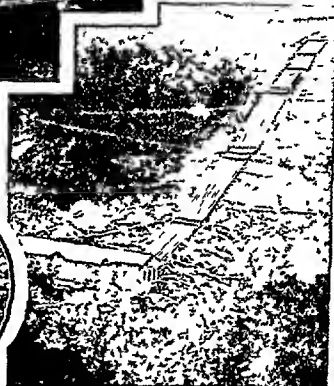


FAIR GIRLS of the Gøteborg Ford region greet us in local costume, above.

HUGE PIPES bring water to the great hydro-electric plant at Rjukan below. Here the greatest waterfall in Norway is harnessed and nitrates are made from the air. Norway is a shining example of water-power development. Remote farms, factories, railways all use electricity for lights, heat, and power.



MANY OLD SAGAS must have been recited in the room below, which dates from the 14th century when living was hard, stern, and beautiful, as we may judge from the fine strong lines of the furniture, the simple carvings, and the staunch old platters and bowls.



"ANY FRESH FISH TODAY?" Bergen's fish market, in the oval, is one of the busiest places in Norway. The old-time romantic but dangerous fishing fleet has now been largely replaced by modern vessels equipped with steam auxiliary engines, or motor boats.



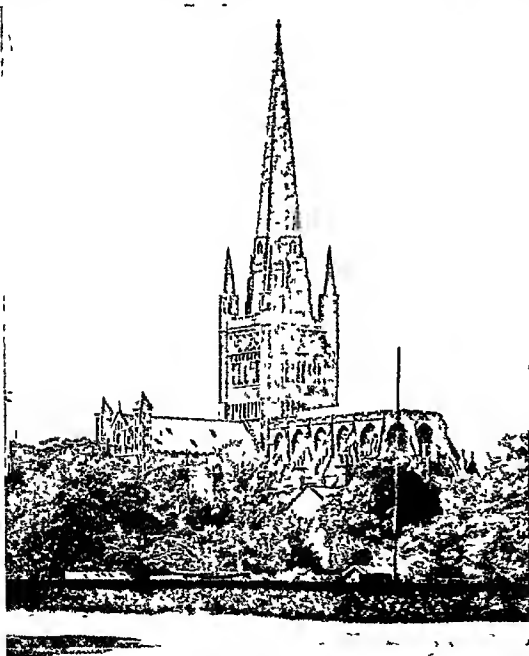
THE LAPLANDERS are a mysterious race who live in the northern part of Norway, Sweden, Finland and Russia. These Norwegian Lapps at the right, squatting gloomily before their tepee-like tent, are typical of this nomadic race which has lived for more than 5,000 years among the tall, blond, civilized Norwegians without adding an inch to its five-foot average height or altering a jot of its half-barbarous manner of life. The Lapps herd reindeer and eat dried deer meat, fish and yellow raspberries. Of the 30,000 Lapps, 19,000 live in Norway.



KINGS AND QUEENS still go to the old stone-blue Cathedral of Trondheim, above to be crowned. The famous old Viking St. Olaf, it is buried in this cathedral.

"pelagic" whaling factory-ships, each accompanied by six or more steam whale-catchers, visits the Antarctic whaling grounds, returning regularly with enormous cargoes of oil and bone meal. Whaling is one of Norway's most profitable industries, and whale oil is exported in considerable quantities. More than twenty per cent of the total area of the country is timber-land, and about three-fourths of this is pine. Lumber, wood-pulp, and other forest products are among the principal exports.

The mining industry is relatively unimportant. Copper, nickel, and silver are found, and considerable quantities of iron, but coal is entirely lacking on the mainland. In spite of the lack of coal, Norway has been able to develop manufactures to a considerable extent, owing to its splendid water-power resources. Chemicals, machinery, wooden ware, silk, cotton and woollen goods, and paper are leading products.



SPLENDID CATHEDRAL OF NORWICH

The beautiful cathedral at Norwich, seen above from the cricket ground, lies in a hollow between the river and the castle. Founded in 1096, it was rebuilt two centuries later; the spire, in the Perpendicular style, and the roof of the nave, date from the fifteenth century.

The Norwegians are among the busiest sea-traders in the world, with a merchant marine greater than that of many a far larger nation. In recent years Norwegian shipowners have made a specialty of building oil-tankers, and today these carry a large share of America's export oil trade. Steamers are the most important means of communication between Norwegian ports, although railways also are well developed. Telegraphs and telephones are found in the remotest places, and the mail service is prompt and adequate. Education is compulsory, and there are excellent schools and more than 1,000 state-endowed libraries. The Royal Frederick University at Oslo is the chief educational institution.

The government of Norway is a constitutional monarchy. The king exercises his authority through a Council of State composed of a Minister of State and at least seven other ministers, appointed by the king. The Parliament (called Storting) is divided after election into two houses. Since 1913 women have enjoyed the franchise on an equal footing with men. The State Church is Lutheran.

From the fiefs of Norway in the early Middle Ages set forth some of the most famous of the Vikings whose raids long troubled Europe (See Northmen). The land was united into a single kingdom in the 10th century and Christianized in the 11th. In 1397 it was united with Denmark and Sweden in the Union of Kalmar. Sweden seceded from this union 125 years later, but for more than 400 years Norway continued as a dependency of Denmark.

At the close of the Napoleonic wars, in 1815, it was torn from Denmark and handed over to the Swedish king to recompense him for the loss of Finland to Russia, but Norway retained its separate parliament, government, and laws. In 1905 long-standing disputes led the Norwegian Storting to declare this union dissolved. The Swedish king reluctantly agreed to this, and the Norwegians chose Prince Charles of Denmark as their king. He was crowned in 1906, as Haakon VII.

Norwich. (Pron nor'-ij) This city, the ancient county town of Norfolk, stands on the river Wensum near its junction with the Yare. Its chief glory is the beautiful cathedral, begun in Norman times but not finished until 1500. Little remains of the castle, which also dates back to Norman times; part of it is now used as a

J. Davis Scott



READY FOR SKI-JORING'S THRILLS

So popular is skiing amongst the Norwegians, and so proficient are they at this sport, that they have been described as being born with skis on their feet. The young Norwegian girl above is about to go ski-joring, a variation of the sport in which the skier is drawn along by a horse.



Underland

THE GLACIER'S PATH IN NORWAY

The grandeur of Norway's mountains has become familiar to many tourists. Among these peaks of the wild Høring mountains which overshadow the hamlet of Turtre, huge glaciers run across the valley heads. More than 2,000 square miles of Norway are covered with perpetual snow and ice.

county museum Other buildings include St Andrew's Hall, originally the nave of a monastic church The house of Norwich's most famous literary son, George Borrow, is preserved

Norwich is a busy centre, particularly for agricultural products from the farms of East Anglia and for insurance companies Among its industries are agricultural implements and light engineering, boots and shoes, and many other things In the Middle Ages the city became one of the most important in England because of its trade in woollen goods, introduced by the Flemings The population of Norwich today is 126,000

Nottinghamshire, English County

This inland county of lace making fame has an area of 844 square miles and a population of some 712,000 The surface is mainly flat, except in the south-west, where there are some rolling moorlands and hills The Trent is the chief river, forming in part the eastern boundary

The county is finely wooded Although many have been cut down, there are still some magnificent old trees left in Sherwood Forest, especially in the part known as the Dukeries, which once contained the residences of four dukes Sherwood Forest was originally a royal forest, and is remembered as the haunt of Robin Hood and his merry men

Besides the making of lace and hosiery, engineering is an important industry Much coal is mined, and clay, sandstone, and limestone are quarried

There are several notable mansions in the county In the part called the Dukeries, are Clumber House, Thoresby House, Worksop Manor, and Welbeck Abbey, with its underground passages and vaults made by the eccentric 6th Duke of Portland Wollaton Hall, near Nottingham, is a splendid late 16th-century building, and there are other fine mansions at Southwell, Scrooby, and Shelford About eight miles from Nottingham is Newstead Abbey, where Lord Byron lived It was formerly an



OPENING NOTTINGHAM'S GOOSE FAIR

A town which is reputed to contain the prettiest girls in England needs no excuse for making merry, and an air of light-heartedness always enlivens Nottingham This is particularly manifest at the annual Goose Fair which is at least 800 years old Above, the Lord Mayor of Nottingham is seen declaring the Fair open

Augustinian priory, and parts of the old monastic buildings remain

Most of the county is in the diocese of Southwell Nottingham (population, 268,000), famous for its lace and its annual Goose Fair, is the county town, it stands on the Trent Other important towns are Newark (18,000) and Mansfield (46,000) In the ruined castle at Newark King John died in 1216 Coal seems to have been worked as far back as 1259, when Queen Eleanor complained of the smoke

Noun. A noun is a word that *names* It may name anything of which anybody may think or speak—as *school, London, kindness, justice, children* If it is the name of one particular person or object or place, it is called a proper noun In this sense “proper” means “belonging exclusively to” Your name, *Frank* or *Mary*, is a proper noun, because it belongs to you and distinguishes you from other persons *London, Saturday, Scotland* are proper nouns

Any noun that is not a special individual name is a “common” noun—as *cloth, man, book, etc* Such nouns are called “common” because they belong to more than one person

or thing. A special kind of common noun is the "collective" noun, which stands for a group of things or persons, as *class*, *flock*, etc. (See *Multitude*, *Nouns* of)

Most nouns in English have two forms, according to whether they mean one object or more than one. The form which denotes one is called the singular number, and the form which denotes more than one is called the plural number—as *bird*, *birds*. The plural is generally formed by adding *s* to the singular. When adding *s*, nouns ending in *y* after a consonant change the *y* to *e*, as *city*, *cities*. Several nouns ending in *f* or *fe* change the *f* to *v*, as *self*, *sheaves*, *knives*, *knives*.

Some nouns ending in *o* add *es*, others add *s* only—as *caro*, *cargoes*, *piano*, *pianos*. Nouns that end in a sound difficult to pronounce with a final *s* add *es*—as *church*, *churches*. A few nouns form their plurals by adding *en* or by changing the internal vowel—as *ox*, *oxen*, *tooth*, *teeth*. The adding of *en* was the common way of forming plurals in Old English. There are also some foreign plurals in common use—as *stratum*, *strata*, *crisis*, *crises*. A few nouns make no change.

Many nouns, especially those denoting persons or animals, have another form called the possessive case, because it is possession, like the genitive case in Latin. Singular nouns and all plurals not ending in *s*, add the apostrophe and *s* to form the possessive—as *lady's*, *children's*. Plurals ending in *s* add the apostrophe only—as *ladies'*, *boys'*.

In ordinary use, most names of things are not used in the possessive, instead of the book's cover, the chair's back, the usual form is the cover of the book, the back of the chair. But nouns denoting time are often found in the possessive—as *a day's work*, *a night's lodging*, *a seven days' journey*.

Besides the possessive case, nouns, like pronouns, have two other cases, according to the construction in which they are used. Nouns do not change their form to distinguish these cases, though most pronouns do. Nouns and pronouns used as the subject substantive of a verb are said to be in the nominative ("naming") case. Nouns and pronouns used as either the direct or indirect objects of verbs or verbal nouns, and as the objects of prepositions, are said to be in the objective case. A noun or pronoun in apposition to another (that is, used to modify or explain the meaning of

another noun or pronoun meaning the same person or thing—as "Caesar, the conqueror") is put in the same case as the word it modifies.

To give in order the various forms which a noun or pronoun may take to indicate different meanings or uses in the sentence is called "declining" it, or giving its "declension." Thus the declension of *child* is singular, nominative and objective, *child*, possessive, *child's*. Plural, *children*, *children's*.

In addition to number and case, nouns, like pronouns, have two other properties: gender and person. (For a discussion of grammatical person, see *Pronouns*.) Nouns, except those in direct address, are always in the third person.

By gender in English is meant merely whether the noun denotes male or female, or the absence of sex—as *prince*, *princess*, *table*. Nouns denoting males are masculine, those denoting females, feminine, and those denoting things without sex, neuter. Nouns which refer to both sexes are said to be of common gender—as *people*, *birds*, etc.

In foreign languages the division into the three genders is often quite different from the English system. For instance, in Latin, river (*fluvius*), table (*mensa*), and town (*oppidum*) are respectively masculine, feminine, and

neuter, while in English all three are neuter. In German, the word for girl, *Mädchen*, is neuter, and so too is *Fraulein*, young lady.

Some of the chief constructions in which nouns may be used are illustrated in the sentences given in the centre of this page.

Nova Scotia, CANADA. Geographers have aptly called the maritime province of Nova Scotia "the door-step of the continent," for it lies at the entrance to the St. Lawrence river, the passage-way to the interior. It occupies the south-eastern peninsula of Canada and the adjoining island of Cape Breton, and is connected with the mainland only by a slender neck of land. The principal city is the great port of Halifax (*g v*), one of Nova Scotia's twelve deep and spacious harbours.

Though one of the smallest provinces of Canada, Nova Scotia supports a large population in the settled districts, having over half a million people. The majority are of British stock, a large proportion being descendants of the United Empire Loyalists who left the United States during the Revolutionary War. Another considerable group is descended from the original settlers, the French Canadians or

HOW NOUNS MAY BE USED

Subject and predicate noun	A <i>shilling</i> saved is a <i>shilling</i> gained.
Direct object	He saved a <i>shilling</i> a week.
Object of a preposition	He kept account of every <i>shilling</i> that he spent.
Indirect object	The occasion gave that <i>shilling</i> a true second use or complementary object. I will make your wages a <i>shilling</i> a day.
Possessive modifier	Give me a <i>shilling</i> s worth of sugar.
Adnominal use (objectively like in adjective)	This is a <i>shilling</i> too.
Appositional	His reward—a <i>shilling</i> —seemed enormous.



A FISHING PORT OF NOVA SCOTIA

The Canadian province of Nova Scotia was a French settlement early in the 17th century, and was known as Acadia until it was ceded to the British by the Treaty of Utrecht in 1713. Though it is largely an agricultural province, its fisheries are among the most important in Canada. Lunenburg, seen above, is a fishing port on the south-east coast of the province, and the seat of a large German colony. Here many boats are fitted out for the fishing fleets which operate off the Grand Banks of Newfoundland. The produce of these fisheries is one of the main sources of Nova Scotia's prosperity.

By courtesy of Department of the Interior, Canada

Acadians, many of whom were deported by the English in 1755.

Nova Scotia is a region of extensive sea-line, of bold rugged shores and noble highlands. Since the days when it was first settled by the French and called Acadia, fishing has been one of the principal industries. The Nova Scotians, or "Blue noses" as they are sometimes called, are among the finest seamen in the world. It is said that they can handle a small boat in rough seas better than any other race.

Considerable stretches of the "forest primeval" still stand and furnish another source of wealth. In the more progressive saw-mills improved machinery has been installed, and great quantities of lumber are shipped each year from Halifax. In the northern part of the peninsula and in Cape Breton Island are rich coal mines, which produce about half of Canada's coal. The coal fields embrace some 1,000 square miles and their annual production is about five and a half million tons. In the southern part

are small gold-mines and rich deposits of iron ore, the amount of fine gold produced in 1936 was 9,857 ounces.

These industries of fishing, lumbering and mining are, to a large extent, in the hands of the British, for the Acadians are farmers, as they were in the days described in Longfellow's famous poem "Evangeline."

When the peninsula passed from France to England, in 1713, the name Acadia was dropped and that of Nova Scotia ("New Scotland") became the official name of the colony. Some of those who had been driven from their homes found their way back in later years, and from these are descended the Acadians of today. (See Acadia, Halifax.)

Nova Scotia is a favorite summer resort with the people of the eastern United States because

of its delightfully mild summer climate and the picturesqueness of its coasts, meadows, and orchards. The marshy land which spreads inland along the small rivers flowing into the Bay of

Area—21,428 square miles, of which 21,068 are land

Population—512,840

Physical Features—Peninsula of Nova Scotia and Cape Breton Island to the east form a Province of uplands, with areas of forest. Several islands off the coast and lakes (including Rossignol and Bras d'Or).

Products—Fruit, dairy, wool, coal, lumber, fish

Principal Ports—Halifax (59,000), Sydney, Glace Bay

Fundy is amazingly fertile. Nearly all of it has been dyked to protect it from the extremely high Fundy tides. The beautiful Annapolis and Cornwallis valleys are thick with apple orchards.

Almost from the time of the founding of Port Royal (now Annapolis) by the French, in 1604, Nova Scotia was a focal point in the struggle between the French and the British for the New World. Fighting was almost continuous until the final blow to French aspirations was

delivered, in 1759, by the capture of Quebec. The previous year had seen the capture of the "Dunkin' of the North"—the famous fortress of Louisbourg which the French had built on the Atlantic coast of Cape Breton Island to be the keystone of their naval power in America. Although the peninsula was won by the British in 1713, the island was not ceded until the peace of 1763. In 1867 Nova Scotia became part of the Dominion of Canada.

A READER'S GUIDE to GOOD FICTION

The novel is, of course, the most popular form of literature, indeed, most people read no other form. But we should be careful how we choose our fiction, this article will act as a guide.

Novel. People who read novels have a magic carpet that takes them where they will—to visit distant lands and ages and to mingle with all sorts and conditions of men. Many of the characters in fiction are more real to us than those in history, we feel as well acquainted with them as with the people we meet in real life and often understand them better.

What makes a good novel? There are three essentials in the novel—characters, plot, and setting. A good novel represents life-like characters talking and acting under interesting circumstances, and through their acts becoming

involved in a complication of events which is brought to a satisfactory conclusion. But many excellent novelists show no such harmonious development of these three elements. Dickens, for instance, often pays little attention to plot, while with Scott the portrayal of character is subordinate. It is impossible to lay down hard and fast rules, for it is the privilege of a genius to break all rules of art. But one thing we can demand of a novel and that is that it must ring true. Even a romance must not violate the fundamental truths of human nature. Worst of all is the novel that pretends to picture "real life," and gives a false and distorted picture. It is hard to measure the harm that is done by books of this sort.

Nothing exactly like our novel of today was known in ancient times, though the Greeks and Romans had their prose tales and romances, such as the "Golden Ass" of Apuleius, which contains the beautiful story of Cupid and Psyche.

Forerunners of the Novel

The immediate ancestor of the modern novelist was the minstrel of the Middle Ages who travelled from place to place telling or singing his tales. Romances, long-drawn-out and full of high adventure, were popular with the upper classes, because they found in them an idealized picture of their own lives. The lower classes liked tales that poked fun at the valiant knights and pious churchmen, stories of rogues and rascals seeking adventure, or of life as they themselves lived it. So alongside of the motional romances we find the *fabliaux*, telling lightly in verse stories of ordinary life and similar stories in prose, called by the Italians *novelle*, meaning "new stories," from which the English term "novel" is derived. A little later there appeared in Spain another type of story dealing with low life, the "picaresque" novel, which told at considerable length the adventures of a *picaresque*, or rogue as the romance sang the noble deeds of the knight-errant. Somewhat akin to these picaresque novels and yet different from anything that had appeared before was



DAVID COPPERFIELD

One of the best-known of Dickens's novels, "David Copperfield" was illustrated by the celebrated artist, Hablot Knight Browne, better known by his pseudonym of "Phiz." The etching above shows David's meeting with his aunt, Betsey Trotwood, in the garden of her house above the cliffs of Dover.

Cervantes' famous burlesque romance "Don Quixote" (See Cervantes)

The two classes of stories—the romance on the one hand, and the *fabliau*, *novella*, and picaresque novel on the other—grew up side by side and were the forerunners of the two main types of modern prose fiction, the "romance" and the "novel." The term novel is now usually applied to a narrative of considerable length with a more or less intricate plot, which pictures life as it is, dealing with characters and events that have been or might be real. The romance gives greater freedom to the imagination, deals with more unusual aspects

of life, and is usually more concerned with telling an exciting story than with the study of character. Thus Scott's "Ivanhoe" may be styled a romance, while George Eliot's "Mill on the Floss" is a novel. In common usage, however, any work of prose fiction is called a novel, the two kinds being called "realistic" and "romantic" novels.

Many prose romances were written in England in the Elizabethan period, the age of Shakespeare, though they are quite overshadowed by the great dramas of that time. Lyly's "Euphues" is remarkable for its elaborate artificial style, its involved and nicely balanced phrases.

Bunyan's "Pilgrim's Progress," the great Puritan prose epic, did teach the masses and still holds its popularity because of its truth to human nature. Although it is an allegory, it is, strange to say, in some ways very much like the old picaresque or rogue novel, only here the adventures of the hero are symbolic and spiritual.

England's First Real Novelist

"Robinson Crusoe" is often called the first English novel, yet it is hardly a novel in the modern sense. It is a tale of adventure in a far-away place rather than of life as we know it, it lacks plot, being a series of happenings loosely strung together, and there is no character analysis. The novel of ordinary domestic life and manners owes its beginning, in the middle of the 18th century, to an accident. Samuel Richardson, a London printer, was invited by a



BEATRIX DUBS ESMOND HER KNIGHT

In "Henry Esmond," Thackeray wrote what many consider to be the finest historical novel in the English language. The scene depicted above shows Beatrix dubbing Henry Esmond her knight for his gallant conduct in Marlborough's campaigns. Behind Esmond stands Beatrix's mother, Lady Castlewood, and on the left is Esmond's step-mother, the Dowager Viscountess Castlewood. This painting, by A. L. Egg, is in the Tate Gallery, London.

Photo T. R. Mansell

publisher to prepare a volume of letters which might serve as models to letter writers. It occurred to Richardson that the letters would be more instructive and interesting if they were made to tell a connected love story and point a moral. The result was "Pamela, or Virtue Rewarded." So great was its vogue, especially among women, that it was followed by another novel, "Clarissa, or the History of a Young Lady," which was usually considered Richardson's masterpiece, and then by one with an ideal man as its hero, "Sir Charles Grandison." Richardson's fault was his pretentious moralizing. Henry Fielding was moved to burlesque "Pamela" in "Joseph Andrews," but he became so interested in his characters that the result was a realistic novel rather than a burlesque. Here, and most of all in his masterpiece "Tom Jones," we feel that his characters are real flesh and blood.

Neither Richardson nor Fielding, nor their contemporaries, Smollett and Sterne, great as they were and important as their work was in the history of the novel, have a wide appeal today. But one novel written just a little later still remains a favourite of young and old. That is Goldsmith's "Vicar of Wakefield," a delightful story of simple home life.

In the early part of the 19th century there was a great interest in the Middle Ages, and the historical novels of Sir Walter Scott were a natural outcome. The Waverley Novels were



HEROINE OF GOETHE'S FIRST NOVEL

This vignette by Daniel Chodowiecki is an illustration from Goethe's first novel, 'The Sorrows of Young Werther,' written in 1774. Werther, calling to take Lotte to a ball, surprises her in the act of cutting bread and butter for her brothers and sisters. The very sentimental story is a tragedy of unrequited love, and was suggested to the author by the actual experience of a young acquaintance of his.

From Kunstedt's Bibliographie zur Geschichte der Deutschen National-Literatur

copied all over Europe. During the same period, far off in a little English village lived a gentlewoman who was not interested in depicting the world of history or even the world of her own day. Jane Austen wrote novels which gave a universe in miniature—the life of her own rural England. She wrote about the people that she knew and with sly humour showed character so skilfully that Sir Walter Scott liked to compare her with Shakespeare. "Pride and Prejudice" and "Emma" are books which sparkle at the third reading as much as at the first.

The 19th century saw the field of the novel immensely widened, to keep pace with the growing complexity of life. Old laws no longer fitted new customs, and a new race of writers grew up to combat them. Charles Kingsley, Miss Gaskell, Charles Reade, and, above all, Charles Dickens, were writers of the humanitarian novel. Perhaps the first two writers felt just as keenly as did Dickens, but they did not possess in so great a degree the humour, pathos, power of description, and realism that made Dickens's work endure. His own life-story, with some modifications, forms the basis of "David Copperfield."

Dickens was of the people. Thackeray belonged to the upper classes. History was fascinating to him and became the background of some of his best novels, as in "Esmond" and "The Virginians," among others. The book by which most people know him best is "Vanity Fair," in which he exposes the shams and meanness of fashionable society.

George Eliot (Mary Ann Evans), who wrote a little later, did not depict the world as a dramatic spectacle, as did Dickens and Thackeray. She was more interested in the minds and souls of her characters. She knew how to make the struggle in a little girl's mind as interesting as a battle. When one remembers that Maggie in "The Mill on the Floss" is really George Eliot herself, it is easier to see why the author has such an uncanny insight.

As we come down to recent and present-day English writers, we find R. L. Stevenson, the disciple of Scott and of the French romancer, Dumas, George Meredith, carrying the novel of the mind and manners to such an extreme of complexity that only the most resolute reader can follow him, and Thomas Hardy, writing realistic stories

of the English countryside which have all the elements of memorable fate in a Greek tragedy.

Still later came Barrie, Bennett, Wells, Galsworthy, Conrad, and a host of others. Wells, who began with scientific romances, has become mainly concerned with social reform. Arnold Bennett, who wrote books that recall the old Flemish painters in their careful detail and their faithful description of ordinary experiences, learned much from the great French masters of fiction. His best work centres about the "Five Towns" of the pottery industry of England. Barrie had a romantic whimsical style all his own. Galsworthy drew sombre pictures of the injustices of modern society. Joseph Conrad, born a Pole, but living the greater part of his life as an officer in the English Merchant Marine, wrote of the sea and of strange lands in novels that are masterpieces of style and of insight into character. (See further English Literature)

Novels in the New World

The novel in America showed much the same tendencies as in England. James Fenimore Cooper in the first half of the 19th century "laid the foundations of American romance" and won the title of "the American Scott." Hawthorne probed deep into the recesses of the human mind and soul. In the later 19th century and reaching well into the still more complex 20th century, we find Henry James writing of psychological novels, appealing to a small circle of readers, and William Dean Howells, distinctly a realist of

everyday American life Upton Sinclair, a vigorous exposé of social evils, Sinclair Lewis, a satirist of the front rank, and Edna Ferber, author of "Show Boat," "Cimarron," etc., are among America's best modern novelists (See United States Literature)

We can only glance at the novel in other lands. It is to Italy, in a sense, that we owe the novel form, but the Italian "novella" was really more like our short story than our novel. Alessandro Manzoni in the 19th century is the first modern Italian novelist of international importance, and Matilde Serao and Gabriele D'Annunzio (the latter better known as a poet and dramatist) were his greatest successors.

In Spain there has been no name as great as that of Cervantes, but since the middle of the 19th century the novel has been a very popular form. The best-known names are Fernán Caballero, Pedro Antonio de Alarcón, Pereda, Galdós, and Blasco Ibáñez, the last probably more widely read in England and America than in his own country.

In the Scandinavian countries Bjørnson, the greatest novelist of Norway, was followed by Selma Lagerlöf, who wrote the folklore of Sweden into beautiful romances, and by Johan Bojer and Knut Hamsun, who have produced powerful realistic works.

Henryk Sienkiewicz, author of "With Fire and Sword" and other historical romances dealing with the struggle of the Poles, is the chief representative of Poland. He is perhaps best known in other countries for his "Quo Vadis" a novel of the time of Nero. In Germany in the 18th century Goethe wrote the most famous of sentimental novels, "The Sorrows of Young Werther," and the great autobiographical novel, "Wilhelm Meister." Then came the picturesque humorous stories of Jean Paul Richter, and the romances of Tieck, Fouqué, Von Kleist, and many others. Paul Heyse, Gottfried Keller, Hermann Sudermann, Erich Remarque, and Heinrich and Thomas Mann are among the most important German novelists of recent times.

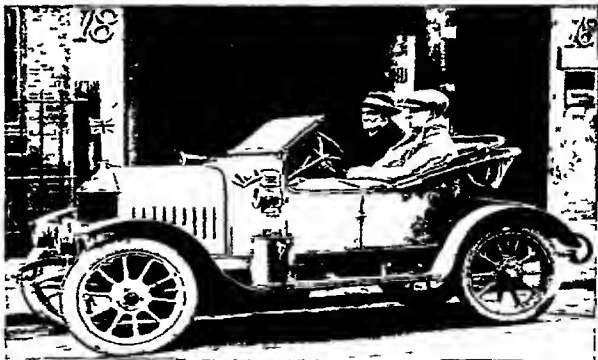
In France it was not until the 19th century that the novel became one of the chief forms of imaginative writing. Victor Hugo and Alexandre Dumas were inspired by Scott to enter the realms of history and romance. Flaubert in his famous "Madame Bovary" combined romanticism and realism. Balzac insisted that

fiction must be based on observation and experience, and was largely influential in spreading realism throughout Europe. Zola went farther, attempting to dissect human nature, and dwelling for the most part on its sordid aspects. French idealism was seen again in Romain Rolland's biographical novel 'Jean Christophe,' which gave a wonderful picture of Europe before the World War.

Perhaps no other country has had so great an influence on recent fiction as has Russia. The powerful novels of Gogol, founder of the modern realistic school in Russia, of Turgenev, one of the greatest prose artists of the 19th century, of Dostoevski, with his subtle psychology, and of Tolstoy, great in this as in many other fields, have come as a challenge to the rest of the world. (See also articles on the literatures of the chief countries mentioned.)

Nuffield, WILLIAM RICHARD MORRIS, 1st Viscount (born 1877). Born at Worcester, October 10, 1877, young Morris was educated at the village school of Cowley near Oxford, and began his career as an apprentice to the cycle trade in a small repair shop in 1894. Nine months later he set up in business as a bicycle maker, rising with machines of his own construction and winning seven county championships in 1900. Having gained some engineering knowledge, he began shortly after 1900 to build motor bicycles, followed in 1912 by light cars of robust construction, but economical to run, the need for which he had clearly perceived.

The business thrived during the War, and after it was over Morris embarked on mass-



LORD NUFFIELD'S FIRST CAR

Viscount Nuffield, then plain Mr. William Morris, built his first light car in 1912, and here he is seen at the wheel of the original one of the series. Since the War, the firm of Morris Motors has forged rapidly ahead and absorbed several other companies. Lord Nuffield has of late years put mankind in his debt by his enormous philanthropic gifts.

By courtesy of Morris Motors Ltd.

production of family cars on an enormous scale. His great organizing abilities, coupled with his policy of catering for a vast market, rapidly established his firm as one of the largest car makers in the world. Both the creation and the continued success of the vast Morris combine, employing thousands of workmen all over the world, are due to the industrial and commercial genius of one man. For his great services to industry and his philanthropic work Morris was made a baronet in 1929, raised to the peerage as Baron Nuffield in 1934, and became a viscount in 1938.

To his gifts to various institutions such as the Universities and hospitals there seems to be no end. During 1936 he gave a total of £2,000,000 to Oxford University and another £2,000,000 to the depressed "Special Areas." At the end of 1937 it was estimated that his gifts amounted to more than £11,000,000.

Numerals. From the earliest times men have counted on their fingers, and the system of making straight marks or "tallies" as a record of numbers probably grew out of this practice. When the habit arose of "scoring" tallies with cross strokes into groups of five, each group obviously represented the fingers of one hand. After a time this was found to be too small a unit, and men came to adopt the "decimal" system of counting by tens, representing the fingers of both hands.

Of all the older systems of number notation, the Roman system is the best-known. Indeed, we still use it for certain purposes, such as marking the hours on clock dials and numbering the volumes and chapters of books. In this system seven letters are used to represent numbers, with the value given below:

I	V	X	L	C	D	M
1	5	10	50	100	500	1,000

The letter *C* is the initial letter of the Latin word *centum*, meaning "hundred," and *M* that of *mille*, "thousand." When a letter of less value is written *before* one of the greater value, the numeral represents the *difference* between the two values. Thus IV equals 4, XL equals 40, XC equals 90. When the letter is written *after* one of greater value, the sum of the two is represented. When a bar is placed over a letter its value is multiplied by 1,000. Thus \overline{V} equals 5,000, \overline{XLV} equals 14,000. The table in this page explains the system.

In part the greater simplicity of the so-called "Arabic" system is due to the fact that each

of the Arabic digits is a single character (1, 2, 3, and so on, up to 9), instead of being composed, as most of the corresponding Roman numerals are, of several characters or letters (II, III, IV, and so forth). It is also due to the fact that the Arabic system is based on an improved principle, that of place value. In the number 555, for example, the 5 at the right stands for 5 units or ones, the middle 5 for 5 tens or fifty, and the one at the left for 5 hundreds. This makes possible a *decimal* system, the place value of the numbers increasing tenfold to the left of the units figure and decreasing in the same ratio to the right.

Before Nought Was Invented

The Arabic system of numbers is a convenient one, but before the nought or zero was invented, for several hundreds of years after the system came into use, men found it difficult to write such a number as 1,030, or 3,042,050. The invention of the nought made possible the simplified arithmetical processes in use today in place of the older ones which required the "abacus" or counting frame. It gave the world a system of numbers which has proved a

great help in advancing both science and trade. The nought is for this reason considered one of the great inventions of the world.

In their earliest form the Arabic numerals were not Arabic at all, but came from the Hindus of far-off India.

The first trace that we

have of them (without the nought, however) is in some rock-cut inscriptions in Central India, which go back almost to 300 B.C. In Europe we find some examples of the nine digits (again no nought) in manuscripts which date from early in the Middle Ages, probably derived from contact with the Saracens, who then ruled Spain.

But the real introduction of the Arabic system into Europe came with the rise of commerce which followed the Crusades. Then for the first time West and East were brought into continual contact, and we may consider the new system of notation as one of the many gains of Europe from the activities of the Italian merchants. The nought was now an established part of the system. The old and cumbersome Roman system, however, was not entirely replaced by the Arabic until the 16th century.

In most everyday problems we calculate in pounds, shillings, and pence, feet, or other definite units (See Weights and Measures). Numbers carrying this meaning as to kind are called *denominate* numbers. But to make these everyday calculations we must have rules and

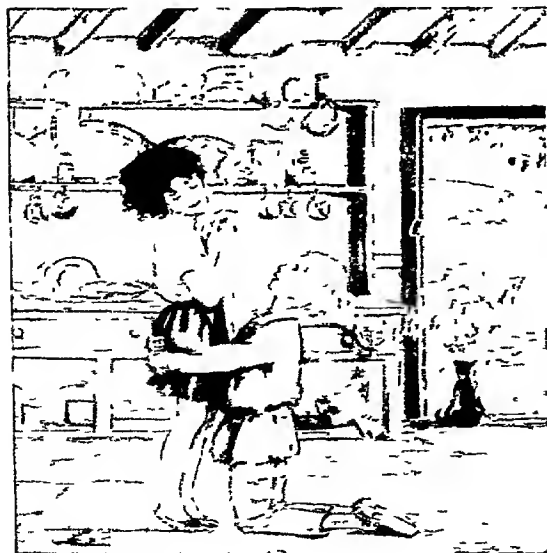
TABLE OF ROMAN NUMERALS SHOWING THEIR ARABIC EQUIVALENTS									
I	1	XI	11	XXI	21	DC	600		
II	2	XII	12	XXX	30	DCC	700		
III	3	XIII	13	XL	40	DCC	700		
IV	4	XIV	14	L	50	DCC	800		
V	5	XV	15	LX	60	CM	900		
VI	6	XVI	16	LXX	70	M	1,000		
VII	7	XVII	17	LXXX	80	MM	2,000		
VIII	8	XVIII	18	XC	90	IV	4,000		
IX	9	XIX	19	C	100	V	5,000		
X	10	XX	20	CC	200	IX	9,000		

CHILDHOOD'S FAVOURITE RHYMES

Pictured in Eight Lovely
Colour Paintings



Mary had a little lamb
With fleece as white as
snow,
And everywhere that Mary
went
The lamb was sure to go



Curly Locks, Curly Locks,
Wilt thou be mine?
Thou shalt not wash dishes,
Nor yet feed the swine,
But sit on a cushion
And sew a fine seam,
And feast upon strawberries,
Sugar and cream

NURSERY RHYMES



Little Polly Flinders
 Sat among the cinders
 Warming her pretty little toes,
 Her mother came and
 caught her
 And smacked her little
 daughter
 For spoiling her nice new
 clothes



A dillar a dillar,
 A ten o'clock scholar,
 What makes you come so
 soon?
 You used to come at ten
 o'clock
 And now you come at noon

NURSERY RHYMES

Ride a cock-horse
To Banbury Cross
To see a fine lady
Ride on a white horse
Rings on her fingers
And bells on her toes
She shall have music
Wherever she goes



Twinkle, twinkle, little star,
How I wonder what you
are—
Up above the world so high
Like a diamond in the sky

NURSERY RHYMES

Buttercups and daisies,
All the pretty flowers—
Coming in the springtime,
To tell of happy hours



Where are you going to, my
pretty maid?
I'm going a-milking, sir,
she said
May I come with you, my
pretty maid?
Yes, if you like, kind sir,
she said



methods. To learn the rules and to develop new methods, we must study numbers by themselves, regardless of the object which they represent. Such numbers are called *abstract*. Digits, by themselves, are abstract. The next simplest class of numbers are the *integers*, or numbers made up of one or more digits, as 33, 4,000, and 2,950. These are "whole" numbers, as opposed to fractions and other classes of numbers.

One of the most useful of these additional classes of numbers is the "negative number." Suppose, instead of thinking of addition as placing more objects in a heap, and subtraction as taking objects away, we work our problems with a button sliding on a wire, marked as below, with 0 for the middle, thus
etc -5-4-3-2-1 0 +1+2+3+4+5 etc

Numbers to the right are marked + and those to the left are marked -. To start, the button would stand at 0. Now suppose we are given the addition, $3+2=?$ First we set the button at +3. Then, since the next number is +2, we move the button two more places to the right (always to the right when the sign is +). The button stops on +5, which is the answer.

Now take the problem $5-2=?$. The symbol "5" without a sign means +5, and that is where the button is. "2" means "move two places to the left" (always to the left when the sign is -). The button stops at +3, which is the answer.

Minus Quantities Explained

So far we have accomplished nothing that we have not done in simple addition and subtraction. But now take the problem $3-5=?$ (This might arise if a boy having three shillings wanted to buy a watch costing five shillings). If we used only positive or plus (+) numbers, and the idea of addition and subtraction as merely adding to or taking from a heap, we could not solve the problem, for we cannot take a greater quantity from a less. But with our button and wire, the problem is easy. We move the button three places to the right, and then five places to the left, and it stops on -2. (In the case of our boy buying the watch, this would mean he got the watch, paid his three shillings, and instead of having three shillings he is two shillings in debt.) Minus 2 (-2) is a *negative* number—that is, it is a number less than 0, so the minus (-) sign now means not only an operation ("subtract," or, on our wire, "move to the left"), but, affixed to a number, it means a number less than zero or nought. The non-mathematical meaning of such numbers varies with the terms of the problem.

Another type of number is one which has a definite value, but this value is not known. A good example would be if we are given some facts indicating the number of pupils in a school-

room, and are asked to find how many there are. To do this we say, "Let x stand for the number," then proceed with our calculations to find what integral number it is that x represents. Such a number as x is called an *algebraic* number, and methods of calculating with such numbers form the subdivision of mathematics called *algebra* ($q.v.$). Only the integral and fractional numbers of definite known value (called *arithmetic* or *natural* numbers), such as 0, 27, $\frac{1}{2}$, 125, and another class called *transcendental*, are used in arithmetic. The transcendental numbers are constant quantities such as the one denoted by the Greek letter π or m , the ratio of the circumference of any circle to its radius, always having the value 3.1416 (See *Geometry*).

Nuremberg, GERMANY. In this Bavarian city the old walls and turrets, the great gateways flanked by massive towers, the irregular streets, and quaint gable faced houses, all carry us back hundreds of years to the time when Nuremberg (German *Nürnberg*) was the gateway through which passed much of the rich goods of the East on their way to northern Germany.

One of the old houses pointed out now as one of Nuremberg's most treasured relics is that in which Albrecht Durer, the great artist lived. It was Durer and his companion artists of the "Nuremberg school" who made this city "the home of German art," and here we can see many specimens of their work. At St Sebald's Church are the Twelve Apostles, the masterpiece of Peter Vischer. Germany's great worker in bronze. The large art museum houses many other treasures.

High above the ancient section of the city towers the old castle with its underground passages and its "chamber of horrors," in which are medieval instruments of torture.

For its greatness as a medieval centre of commerce modern Nuremberg has substituted the great factories outside the old city walls, where are made many things, from huge locomotives to lead pencils and dolls and toys.

Under the Nazi regime Nuremberg has gained added importance, owing to the fact that the Annual Congress of the National Socialist Party is held there.

Nursery Rhymes. The first verses that we hear and learn are usually nursery rhymes like

Humpty Dumpty sat on a wall,
Humpty Dumpty had a great fall,

or

Old Mother Hubbard
She went to the cupboard

that is, rhymes that tell a simple story in simple language.

In spite of much research and discussion it must be admitted that we know next to nothing about the origin of nursery rhymes, for many of them have been handed down by word of mouth

for centuries "Sing a Song of Sixpence" is mentioned in an Elizabethan drama, and "Wise Men of Gotham" seems to have been familiar then too. "Three Blind Mice" is found in a poem published in London in 1609, and "Tom, Tom, the Piper's Son" in a song of 1719.

The first British collection of nursery rhymes was published, under the title "Mother Goose's Melody," by John Newbery in 1760, and it is thought that part of it may have been written by Oliver Goldsmith. "A Frog He Would a-Wooing Go" was written by the comedian John Liston, but it is in part traditional. "Wee Willie Winkie," one of the most charming nursery rhymes, was written by the Scottish poet, William Miller.

More recently there have been verses written by well-known writers which may in time become favourites in the nursery—verses like

A birdie with a yellow bill
Hopped upon the window sill
Cocked his shining eye and said
'Am I you 'shamed, you sleepy-head?'

from R. L. Stevenson's "Child's Garden of Verses," or A. A. Milne's poem, "Christopher Robin is Saying his Prayers."

Nursing. It is only within the past half-century that trained nursing has become a recognized profession. During the Middle Ages religious organizations cared for the sick, and today the Sisters of Mercy are one of several such bodies animated by the same motive. But it was not until the great and noble work of Florence Nightingale (see Nightingale, Florence) that the impetus was given to the movement that lifted nursing to importance and dignity as

a profession for lay members of the community. There is probably no occupation for women which presents a wider field than does nursing. While the term originally meant little besides taking care of the sick, it now includes a large number of public and social duties. Public health work, school health supervision under a doctor, inspection of housing conditions, the direction of medical gymnastics, manual and electrical massage are only a few of the attractive avenues of service open to the trained nurse and the list is constantly growing.

How to Become a Nurse

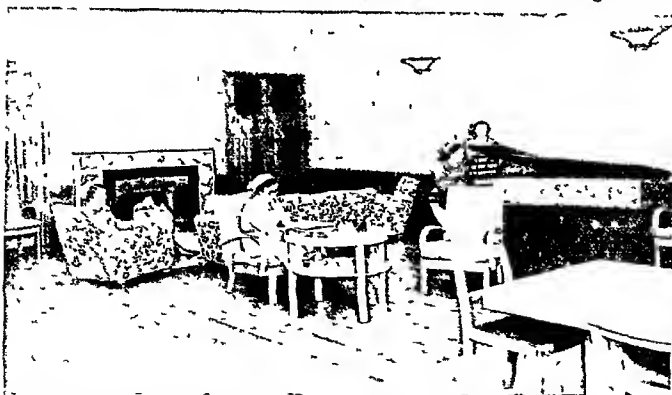
Most general hospitals conduct training-schools for nurses. Application for entrance is made to the superintendent, and after a medical examination the applicant is received for a term of probation. The age minimum is between 18 and 19 years, and it is advisable to make application six months before entry. If, in the few months of this probation, the applicant proves to be physically and mentally able to meet the demands of the profession, she signs an agreement to remain for the rest of the required term. Student nurses receive board, lodging, and laundry free, and a small salary sufficient to buy the uniforms and a few simple necessities. Lectures covering anatomy, physiology, and all departments of medicine are given by the physicians and surgeons, and the head nurses teach bandaging and dressing of wounds, etc.

Nurses have to pass two examinations: the preliminary and final, before they can be registered as qualified nurses by the General Nursing Council. The final examination

must be completed before the age of twenty-one.

District nursing is a branch of the profession often attractive to those who desire a more independent form of work. The most comprehensive district nursing organization is the Queen's Institute for Nurses (See First Aid, Hospitals).

Nuthatches AND **CRITTERS** The nuthatch (*Sitta caesia*) is an expert bird gymnast. He can hop head first down a tree trunk or sideways round it, quite as easily as he can hop up it, for he is furnished with sharp



WHEN NURSE IS 'OFF DUTY'

Photograph

A nurse's life is a strenuous one, and her hours of duty are long. Moreover, the profession of nursing today calls for high efficiency and adequate training in all departments of medicine. It has rather belatedly been realized that the profession must be made more attractive to the best type of women. The photograph above shows the recreation room of the new Westminster Hospital nurses' home, London, opened by Queen Mary on March 1, 1938.



THIS NUTHATCH IS AT HOME

When the nuthatch has found a suitable nesting-hole in the trunk of a tree, he builds up the entrance with mud until there is only sufficient room to allow him to pass in and out—and then it is a tight squeeze!

claws well adapted for holding to the rough bark, and his feet spread wide to aid his grip.

He is also an expert at cracking nuts, as his name—in its older form, "nuthack"—implies. First, he fixes the nut firmly in a crevice of the bark of a tree, and then, swinging his body well forward, delivers tremendous blows with his long beak with unerring accuracy on exactly the right spot of the shell.

Nuthatches are small birds related to the creepers, and, like them, they feed on insects as well as on nuts, and make their nests in the holes of trees or in crevices of rocks, usually plastering up the opening with clay to the required size.

The European nuthatch is a common woodland bird in England. It is about 5 inches long, is slate blue above, buff white below, has a slate-blue and white tail, and the sides are chestnut-red. In summer it feeds chiefly on insects, and in the autumn on nuts, beech mast, hard seeds, and the stones of berries. Often you can hear the nuthatch's strong, clear, boyish whistle, even when you cannot see the bird itself. But in winter it comes close to the house for food, visiting the feeding-table with the tits and other birds, and often chasing them away. If you put a row of nuts on the window sill, then a few inside and on the table, the nuthatch will come right in, taking them one by one. But you must sit still if you want him to do this.

Creepers are found in temperate regions. They are small birds, with long slender bills, and get their name from their habit of creeping up tree trunks, where they find the small insects on

which they feed. Our British creeper, *Certhia familiaris*, is a most interesting little bird, brown above and brilliant white below. It creeps and darts about the tree trunks whispering in a tiny voice and sometimes uttering a soft, aqueaky little song, and it makes a nest of leaves and chips behind broken bark or in crevices.

Nutmeg AND MACE. The fragrant spice we call nutmeg is the seed of the nutmeg tree, *Myristica moschata*, which is a handsome bushy evergreen, with straight and lofty undivided trunk about 25 feet high, the branches extending nearly to the base of the tree. The flowers are small and yellow, and have a fragrance much resembling that of the lily of the valley. From the fruit of this tree is also obtained mace, another popular spice, which has an unmistakable and characteristic flavour of its own, quite unlike that of nutmeg. "The nutmegs must be able to smell the sea" is a common saying, referring to the fact that there have been few successful plantations of nutmegs at any distance inland. Indeed, most of them are on tropical islands, chiefly the Banda Islands of the Dutch East Indies, which are almost covered with nutmeg plantations.

The nutmeg tree blooms and bears fruit continuously. The fruit, which is pale orange in colour and about the size and shape of a pear, splits open, revealing the crimson fibre—the mace—which covers the seed.

When the fruit is collected, the fleshy husk is removed, and the mace is carefully stripped off, dried, and prepared. Then the seed shell is broken off, revealing the hard kernel, the nutmeg of trade. The latter is elliptical in shape, about an inch long, and irregularly ridged. From the smaller nutmegs "oil of mace" is prepared by crushing. The fleshy part of the fruit preserved in syrup is a favourite sweetmeat in the Dutch East Indies.

Nuts. The list of the useful hard-shelled fruits we know as nuts is a long one, and they differ widely in size and flavour. Their use as a food and as an addition to various confections is increasing, and in the markets a great array is offered for sale.

Among favourite nuts are the fruits of the great walnut trees with their wrinkly hard shells enclosed in a round smooth husk on the end of the twig. They grew first of all on the hill-sides of Persia and Asia Minor, and long ago Oriental princes sent them as presents to the rulers of lands where they did not grow.

The chestnut, also, has long been valued. There are famous old chestnut trees supposed to be 500 or more years old, and in Spain especially this tree is highly prized. Like the walnut, it ripens its fruits only in southern England.

One of the hardest nuts to crack but most delicious to eat is the Brazil nut which is grown

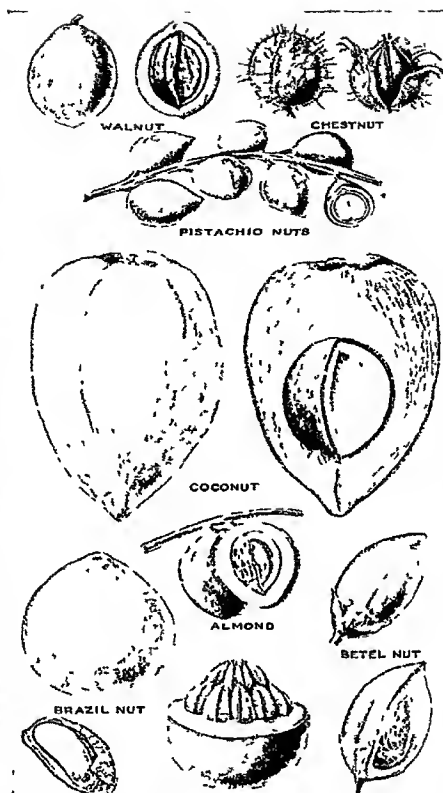
NUTS

in Brazil and other parts of tropics! South America and in French Guiana. These three-sided nuts grow in clusters of 20 or more, tightly packed inside a great hard round shell, the colour of a coconut and as big as a man's head. When the nut is ripe it falls to the ground, and as the trees are 100 feet or more high, it is not surprising that the natives will not go near them if there is a heavy wind.

Pistachio nuts, oily and of an agreeable flavour, their pale-green kernels enclosed in a thin two-parted shell, are seeds of a tree native to Asia Minor.

The almond is a great favourite (see Almond), but the coconut is the most valuable of all nuts. At first it grew only along the East Indies coast and the South Sea Islands, but it can be found now in the tropics of all the continents, and is the chief food of the inhabitants of many tropical lands. This wide distribution was largely unaided by Man. Coconuts can float and are not injured by sea water, so they drift to distant shores (See Coconut Palm). The food value of nuts is high. They usually contain much oil and some protein.

Many nuts are valuable for other purposes. Several are useful in medicine, as the poisonous seeds of *Strychnos nux vomica* of southern Asia and the East Indies, from which we get strychnine. Some are the sources of oil, among them the coconut, the sweet and bitter almond, the hen-nut of the East Indies, the candle-nut of the South Sea Islands, the dika-nut of West Africa, and various nuts of Europe and America. Our native English nuts are the fruit of the hazel (*g v*), and they are grown chiefly in Kent



SEVEN VARIETIES OF NUTS

These pictures show us how certain nuts look in their natural state, and how they look when cut open. Notice that several Brazil nuts are packed together inside the big outer shell.

NYMPHS

Barcelona nuts (which come from Tarragona!) are similar, but grow on hazels of slightly different types.

In structure, nuts vary. Some are enclosed in a soft outer shell, like the walnut, or in a spiny covering, like the chestnut, others are hard-shelled, with no pulpy covering, like the hazel. Some grow singly, like the almond, in others, several nuts grow within one covering as in the beech (See also the articles on the various nut-bearing trees).

Nymphs. To the imaginative Greeks of ancient times, all the seas, streams, fountains, caves, hills, and woods seemed to be peopled with divinities. The fair young goddesses who presided over various parts of the world of Nature were called nymphs. In the limpid springs, fountains, brooks, rivers, and lakes dwelt the Naiads, beautiful water nymphs. The Oceanids (daughters of Oceanus) were nymphs of the great sea which was believed to surround the whole earth. The Nereids were the nymphs of the Mediterranean, clad in their flowing green robes, they might be seen dancing over the waves. Of their number was Thetis, the mother of Achilles. The Oreads, or mountain nymphs, represented as tall graceful maidens, were the constant companions of Artemis, the huntress goddess. The unfortunate Echo was an Oread. The Napaeads, the shyest of the nymphs, dwelt in wooded vales. Every tree was believed to have its own nymph, called a Dryad or Hamadryad, who was born when the tree began to grow, dwelt in it, suffered if it was mutilated, and sickened and died when the tree withered and perished. Although Dryads were subject to death, they remained young while they lived.



As far back as we can trace the letter O, it has undergone little change. Its first appearance seems to be in the Phoenician alphabet as a slightly irregular circle. It was supposed to represent an eye and was called *Ayin*, the Phoenician word for "eye." In the Greek alphabet, as we now have it, there are two characters for this letter, great O (*Omega*, Ω) and little O (*Omicron*, ο) but originally there was only one. Such departures from the perfect circle as we find in ancient inscriptions were due to the difficulty of inscribing a circle on stone. Thus sometimes its form is that of an ellipse, sometimes it is square and sometimes it is nearly a diamond. The form of the letter suggests its pronunciation. The sound of "long" O is pronounced while the mouth is rounded, and the back part of the tongue is raised and somewhat rounded. In English the letter has more than thirty uses, alone and in combination, with various sounds—short, long, unstressed, an oo sound (e.g. *move*) and a u sound (e.g. *above*).

Oak. Long ago great forests of oak covered whole sections of England and central Europe, and although they have been gradually cleared with the progress of civilization, the hardy oak still remains among the most important of trees in France, Germany, and southern Russia, supplying quantities of valuable timber. There are more than 200 species of the oak distributed over the temperate parts of Europe, Asia, North America, and northern Africa, a few species extending into the tropical Andes, the Himalayas, the Philippine Islands, and Borneo.

All oaks bear acorns, a fruit peculiar to these trees. The acorn is horn in a "cup," and consists of a tough skin enclosing two cotyledons, equivalent to the two first leaves of most seedling trees, and the germ, the real seed. These cotyledons supply the early food for the root and shoot of the seedling.

In former times pigs were driven out under the oaks in autumn, for they delight in acorns. Squirrels store them for food, those which they forget to eat may plant themselves, and so we find isolated oaks cropping up in strange places, another reason for this is that acorns are dropped by birds, especially pigeons, which are very fond of them.

The English oak (*Quercus robur*) is the biggest and most valuable of all the oak trees. It is our largest native tree, with spreading, sturdy limbs and a girth of anything up to 30 feet. This kingly tree lives to a great age, and some fine specimens which are still standing in England probably date back to the Anglo-Saxon period, the average age of old oaks is about 300 years. This species is liberally scattered over most of the continent of Europe, and it is divided into two types, the sessile oak (*Q. sessiflora*) in which the acorns grow direct on the twigs and the leaves have longish stalks, and the pedunculate oak (*Q. pedunculata*), whose leaves have very short stalks while the acorns are on long peduncles. The sessile sort is also called the durmast oak, and its timber is often mistaken for that of the sweet chestnut.

The next most important European oak is the Turkey oak (*Q. cerris*), which was introduced into England about the middle of the 18th century. It grows very quickly in the southern counties, but its wood does not stand weather like the British oak. You can tell it by the pyramidal outline, by the leaves, which are deeply cut with pointed lobes, and mealy beneath, and by the acorn-cups, covered with fibrous outgrowths. It is a semi evergreen.

This Oak is Evergreen

The ilex or holm oak (*Q. ilex*), so called from its resemblance to holly (Middle English, *holin*, *holm*), is evergreen, and is useful as an ornamental tree affording shelter from the wind, especially near the sea.

About 50 species of the genus are native to America. Among the best known is the white oak (*Q. alba*), a stately, graceful tree, reaching a height of 70 to 100 feet. Its trunk, which often reaches a diameter of 3 to 4 feet, is covered with whitish, furrowed bark, and this gives the tree its name.

The bur or pin oak (*Q. macrocarpa*) is another well-known and valuable American species.



FRUIT OF THE OAK

H. Baile

The acorn, held in its "cup," consists of an outer casing surrounding the hard, white cotyledons, from which the oak seedling gets its first food. As the acorns are on a stalk, you may know that this is a pedunculate oak.



THE OAK AND ITS 'APPLES'

Here is seen a fine specimen of that typically English tree, the oak, with its symmetrical shape, far-spreading boughs and sturdy trunk. On the right are marble galls—hard, brown, excrescences produced on the twigs by minute insect parasites, known as gall wasps.

Photos: top J. Dixon Scott; right Eric J. Hoising.

This is a very tall, hardy, and beautiful tree. Its deep green leaves are very large, and so are its acorns, which are set in tough cups with a noticeable fringe about the edge. The bark is brownish-grey and furrowed.

The red oak (*Q. rubra*) is perhaps the most beautiful of the American species. The round solid top is covered with large, shapely, lobed leaves, which are pink and furry in the spring, green in summer, and deep purple-red in autumn. The bark is dark brown, thick, and furrowed. On account of their autumn colouring this and similar species are often grown in England.

The live oak is another beautiful American form found farther south; it sometimes rises to a height of 60 feet. The branches are spreading and graceful, and are covered with small and glossy evergreen foliage. It is rarely found more than 50 or 60 miles from the Gulf of Mexico.

The timber of the oaks varies greatly from species to species. The English oak is of superior commercial value, the heart-wood being tough, hard, close-grained, and comparatively easy to

work. It excels most wood in durability, defying drought and moisture, and is practically indestructible under cover. The sap-wood is less durable, but is highly valued also. Really good oak of this type is perhaps the finest of all timber where durability, strength, toughness, elasticity, and fine appearance are taken into consideration. But the finest specimens come from Spain and Austria. English examples being usually too gnarled and difficult to work up well for ornamental purposes, for structural work—beams and roof-timbers—the English wood excels. Oak is, however, our traditional wood, and the oldest as well as much of the latest English



furniture is made of it, besides much panelling.

The bur oak is one of the most valuable timber trees in North America, its strong durable wood ranking next to that of the British oak. It is used extensively for shipbuilding and manufacture. The timber of the white oak and other species is also valuable.

The hard galls or 'gall-nuts' so frequently found on oaks are produced by gall-flies, which lay their eggs in the tissues of the trees. The tissues swell up at the point of puncture and form firm nut-like structures, inside which the young of the insects develop to maturity. Each kind of gall-fly produces a different kind of gall. Oak-galls are rich in tannic acid, used in the manufacture of ink and the preparation of

leather At one time oak-bark was also largely used for tanning, the trees being "coppiced" every fifteen years or so, and the bark being stripped from all branches down to quite small shoots Chemical tanning has killed this industry The oak galls of commerce come chiefly from the Levant Aleppo galls are hard and brittle Besides gall flies, innumerable other insects live on the oak or its timber, of these the stag beetle is the best known His grubs burrow in old rotting oak trees and posts

Oats. This grain is valuable as a muscle builder, and it has less starch than other cereals and a fair proportion of available nutritive materials

The world's production of oats is greater than that of any other of the small grains The cultivation of oats is much like that of wheat, but they will grow on poorer soil and in wetter, colder climates than other grains, the hardy varieties growing almost as far north as the Arctic Circle In the bleak climate of northern Scotland, Alaska, Russia, and Siberia oats are a staple food crop The wild parent variety from which the cultivated oats were developed cannot be traced with any certainty The cultivated variety originated apparently in central Europe, and was not known to the ancient Egyptians, Hebrews, Greeks, and Romans But a sort of wild oat (*Avena*) is common in England, it is the one illustrated in page 1929

In warm regions where the heads do not fill out, oats are grown for pasture or for hay Wild varieties are sometimes grown for such purposes Oat straw is used as food for stock and as stock bedding and is of great value as a fertilizer It is also used extensively in paper making, for packing, and for stuffing mattresses

In the grass family oats stand apart from other cereals, which bear their seeds in spikes, for the oat has a loose, branching head having separate kernels There are two main classes of oats—the spreading oats, with a head branching in all directions, and the banner oats, with the kernels waving loosely from one side only of the stem

Many varieties of oats are cultivated commercially They differ principally in the form, colour, or thickness of the grain, in the length of the straw, and in the time needed for ripening All varieties of oats are hardy, and are almost entirely free from injurious diseases, except

rust and loose smut To avoid these diseases scientists have developed some "early" varieties, which ripen before the rust-fungus seriously injures the crop The early kinds also are shorter, and so are not so easily blown down by early gales before harvest-time

Oatmeal is obtained by removing the husks and drying the grain in a kiln, the food made from oatmeal being the familiar porridge It is ground to varying degrees of fineness and treated in various ways to enable it to cook

quicker Oat kernels are called groats or grits, and when finely ground are used for making gruel It is difficult to make bread with oats because the starch grains are exceptionally hard

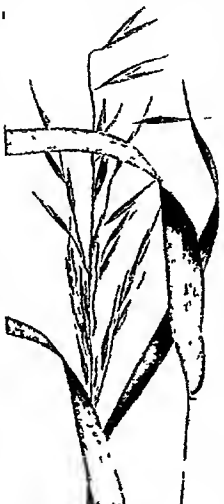
Observatory. The first observatories were the ancient temple towers on the banks of the rivers Tigris and Euphrates, where the early Chaldean priests sought to penetrate the mysteries of the heavens to fix the dates of their religious ceremonies A modern observatory, with its mosque-like domes, reminds us of those earliest temple observatories, but the dome is simply a roof for the huge telescope—sometimes as much as 100 inches in diameter—with which the astronomer studies the heavenly bodies

Setting the telescope for a night's work is an interesting operation First, the astronomer touches a button or lever which, by means of electric motors, wheels the big instrument round to the part of the sky which he wishes to study Another lever shifts into position the dome itself, which rests on rollers, and the shutter is thrown back, opening up the slit through which we see the heavens In some

observatories ladders are employed to bring the observer to the eye piece, but in others motors move the floor itself up or down

To keep the instrument pointed to the star we are studying, we must constantly move the telescope This is owing to the rotation of the earth, which makes the stars appear to rise and set in the same way as the sun does We no longer move our telescope by hand, but by clockwork, which causes the telescope to follow the star

The combined stand and mechanism by which this is made possible is known as an equatorial mounting The telescope is fastened to a graduated circle, called the declination circle The axis of this circle is attached at right angles



OATS

Oats are easily distinguished from rye barley or wheat by their feathery appearance, so noticeable in this photograph

OBSERVATORY

to the axis of another graduated circle called the hour circle. The hour-circle axis is pointed to the pole in the heavens, and the hour circle is parallel to the celestial equator. The result of this combination of axes is a universal joint, making it possible to point the telescope at any part of the sky.

We know that a watchmaker has a difficult task to make an instrument that will keep accurate time to small fractions of a second. But consider that the clockwork of the telescope must be strong enough to move an instrument weighing 20 or more tons, and delicate enough to permit the astronomer to adjust it by hand so as to keep a spider thread $\frac{1}{1000}$ of an inch in diameter constantly cutting in two a star image that is $\frac{1}{1000}$ of an inch in diameter.

Scientific Study of the Sun

If we visit a great modern observatory, we find that besides the telescopes there are a great many other complex and interesting instruments. One of the most important of these is the spectroscope, by which we learn the elemental composition of the sun and stars (*See Spectrum and Spectroscope*). Another interesting instrument is the spectroheliograph, by which astronomers can photograph parts of the sun that could formerly be seen only at the time of an eclipse. In many observatories special telescopes which move only in a north and south plane are used for making time-fixing observations. Telescopes mounted in this way are known as transit instruments.

In our visit to the observatory we are sure to find the astronomers spending more time at their desks than in the operation of their instru-

ments. That is because a majority of the actual observations are now made with photographic attachments. With a photographic plate it is often possible to get results in a few minutes that would require hours to work out with observations made by the eye. The camera is attached at the eye end of the instrument, and the delicate clockwork keeps the great tube pointed at the star or group of stars as long as it is necessary to get a full exposure.

Mapping the Heavens

For several years the great observatories of the world have been engaged in a co-operative project of photographing the whole heavens. This chart of the sky, when it is finished, will comprise more than 20,000 separate photographs. A study of such photographs is of the greatest importance in astronomical work, many new stars have been found by this means.

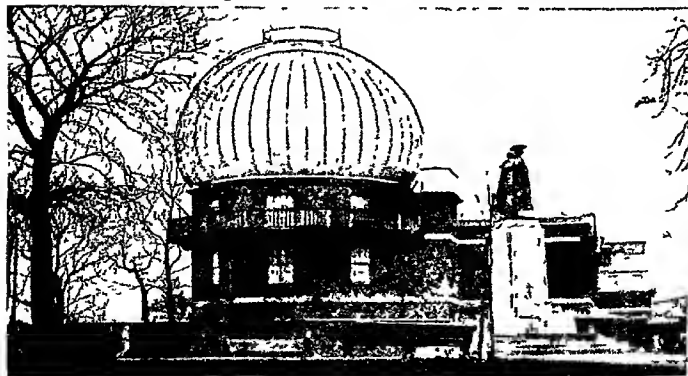
The Royal Observatory at Greenwich was built in 1675. The meridian of Greenwich is used as a basis for longitudes, and from this observatory is reckoned Greenwich mean time. All ships' chronometers are set by, and regulated to keep, Greenwich time, thus affording navigators a certain method of determining longitude east or west of the Greenwich meridian (*See Navigation*).

The observatory at Edinburgh is also a royal observatory. Oxford, Cambridge, and London Universities have important astronomical observatories.

The Yerkes Observatory of the University of Chicago is notable for its 40-inch telescope, the largest refracting telescope in actual operation. The Mount Wilson Observatory possesses the

greatest reflecting telescope at present in use, a marvellous instrument 100 inches in diameter. In 1936 was cast a 200-inch telescope mirror disk for the new observatory belonging to the California Institute of Technology, on Mount Palomar.

In Great Britain there are also meteorological observatories, that is, observatories for studying the weather. The most important of them are at Kew, the central meteorological observatory of Great Britain, and at Balmuccia in Scotland (*See also Astronomy*).

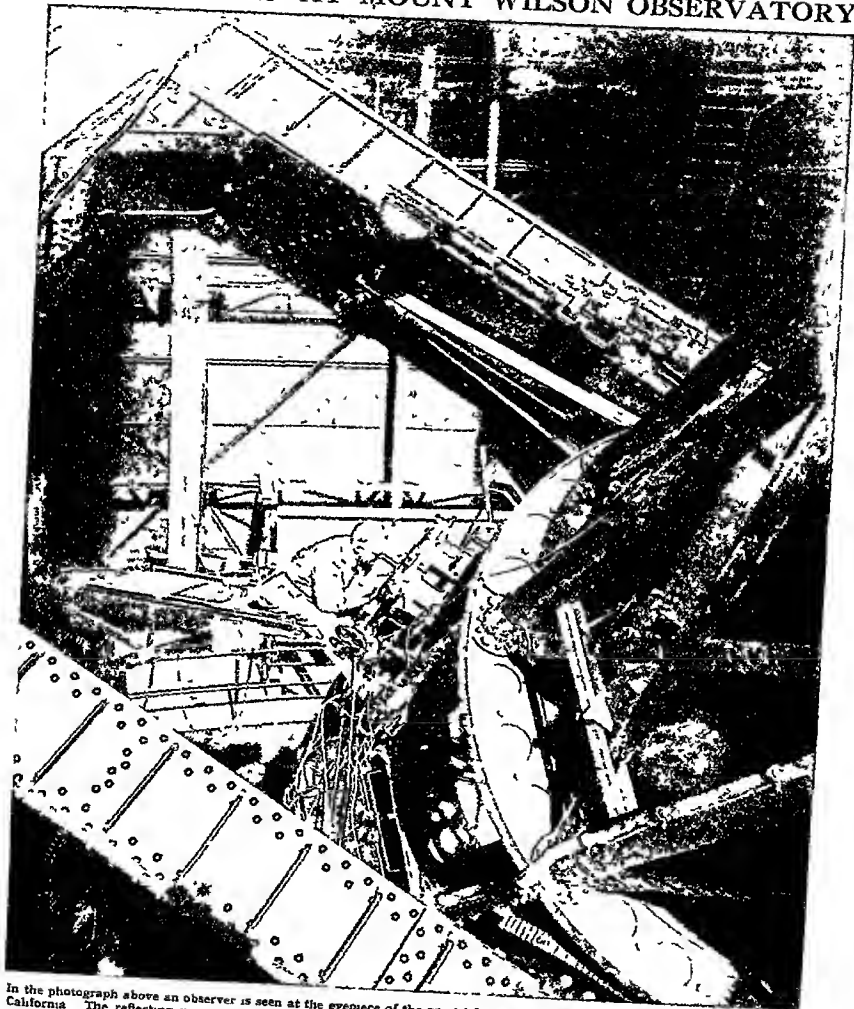


Fox Photos

WHERE THE HEAVENS ARE WATCHED IN LONDON

Greenwich Observatory, headquarters of the Astronomer Royal, was founded by Charles II in 1675 on a hill in the centre of Greenwich Park. Through here runs the zero meridian of longitude used in British charts and maps, and here, too, is reckoned what is known as Greenwich Mean Time. Admiralty chronometers are supplied, repaired, and rated at the Observatory.

'SEEING STARS' AT MOUNT WILSON OBSERVATORY



In the photograph above an observer is seen at the eyepiece of the great telescope at Mount Wilson Observatory in southern California. The reflecting mirror measures no less than a hundred inches in diameter. Making this mirror was a very difficult task, and it took nine years before glass of sufficient purity and size could be obtained and prepared. The observatory in which it is housed stands 6,000 feet above sea level, and materials for its construction had to be brought nine miles up the steep mountain paths from Pasadena.

EXPLORING *the* VAST REACHES *of the* SALTY SEAS

How mighty are the vasty deeps that cover three-quarters of our earth's surface! And how gigantic the mountains and plains and valleys that exist on the sea floor! Here we read of what lies beneath the waves

Ocean. The oceans are gathered into five great basins and together they cover about 72 per cent of the earth's surface. If the sea were 2,000 feet deeper, and the land 2,000 feet lower, there would be nothing left on earth but a few hill-tops in a wilderness of water, and every man would have to be a sailor.

Of the five great oceans, the Pacific Ocean is the largest. It has an area of more than 60,000,000 square miles, and covers a larger surface of the globe than all the continents. Off Mindanao, Philippine Is., it is over 35,000 feet deep. The Atlantic covers some

30,000,000 square miles, and the Indian Ocean 28,000,000 square miles. Both the Arctic and Antarctic Oceans are much smaller, but the figures are uncertain, as large areas are unexplored.

The waters of these oceans cover nearly three-quarters of the earth's surface, or about 140,000,000 square miles, and their volume is 14 times that of all the land above sea-level. Their average depth is about 12,000 feet. The whole volume of water in the oceans, if it were to be frozen into one ball, would form a globe 850 miles in diameter. There are oceanic areas as large as Canada where no soundings have been taken, but we know that the beds of the oceans are not so varied as the surface of the continents. Though they have mountain ranges, plateaus, and vast lowland plains, they are mostly without the hills and valleys which characterize the land.



HOW WE 'TAKE SAMPLES' OF THE LIFE ON THE SEA-FLOOR

So deep, in many places, are the floors of the great oceans, that no diver could go down so far on account of the tremendous pressure of the water above. Yet, strange as it may seem, we know quite a lot about the queer animal and vegetable life which exists down there, as well as of the composition of the soil. Above are shown two of the ways in which we learn about the teeming life on the ocean floor. Purse-nets pick up specimens of animals and plants, and ingenious plumb-lines bring up samples of soil and water

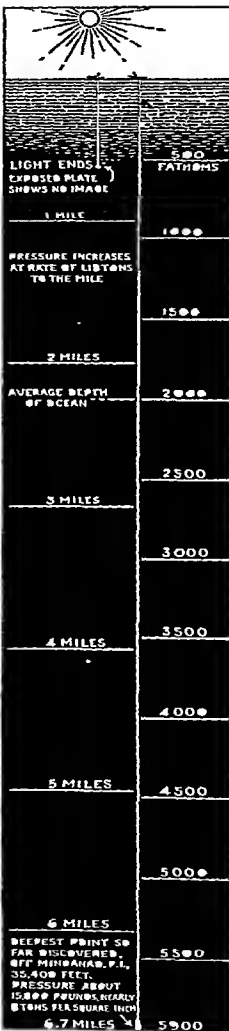
OCEAN

All the water in all the seas is salt, the salt in it being precisely the same salt as we use in our food mixed with it are numerous other minerals. In a gallon of sea-water there is a little more than a quarter of a pound of common salt. The water of the Great Salt Lake in Utah, U S A, and the Dead Sea of Palestine contains much more salt, gallon for gallon. In every cubic mile of sea water there is something like 100,000,000 tons of salt—some of it washed out of the land by the streams and rivers that flow for ever to the sea, some of it there probably from the very beginning. The rivers are dumping salt into the ocean at the rate of over 135 million tons annually, so that the briny deep is increasing in briminess all the time. If the salt could all be extracted from the sea and dried, there would be enough to make a layer more than 100 feet deep over the whole earth.

The water of the oceans contains most of the mineral substances in the crust of the earth. Even when we cannot extract them we find them in seaweeds and sea creatures that have taken them from the sea. Silver has been extracted from the sea by the bottoms of ships sheathed with copper, and it has been estimated that there must be many tons of silver in the sea. Many companies have actually been formed to try to obtain gold from sea-water, but none of them has succeeded.

Even the depths of the sea have not been too dark and inaccessible for scientific exploring, and we know much of the life of the ocean bottom. We know it because there are men who spend their lives exploring the lengths and breadths of the mighty oceans. If looked at from the shore, the sea does not seem to be very mysterious, and a child would hardly guess that the wide blue surface of foaming water conceals beneath it so great a variety of life.

Marvellous indeed is the thought of life miles down in the sea, when we remember that the creatures living there are under pressure equal to that which a man would bear if he were lying under 20 railway trains loaded with iron bars.



BLACK OCEAN DEPTHS
If you could drop Mt. Everest into the deepest part of the ocean, it would not reach within a mile of the surface.

Ocean depths defy man. Man has risen high into the air, has cut out vast cities in the coal under the surface of the earth, but the deep sea checks him, the pressure of the waters is greater than the human frame can bear. Even with Dr. W. Beebe's metal globe called the "bathysphere," which is stout enough to withstand the crushing pressure, we are limited to a depth of a few hundred fathoms. The boldest diver in the ordinary diving suit dare not descend more than 100 yards out of 10,000, and even this journey into the water-world is full of peril. The first man to go down 90 yards into the sea was protected with a metal helmet and a metal breastplate, and air was pumped down to him by six sailors, but he had a terrible struggle to get back alive. The undercurrent of the bottom of the sea swung his life-line about and entangled it, so that he could not reach the surface, and for 20 minutes he fought for his life in the ooze and darkness. Then, after 90 minutes of struggle, they raised him slowly to the top again.

Imagine the weight of the Atlantic Ocean at the depth of a mile or two! With 2½ miles of water over their heads human beings would be crushed, if let down suddenly. On each square inch of their bodies there would be a pressure of no less than 2½ tons.

Even with scientific instruments our knowledge of ocean depths has been built up slowly and in curious ways. One of the first ocean explorers filled a glass tube with air, sealed it, wrapped it in thick flannel, and put it in a copper tube, making tiny holes at the top and bottom of the tube so that water might enter. Then he sent the tube, filled with air, down 12,000 feet. When it came up the thick copper tube was pressed flat, and the glass was reduced to powder. That was the experiment which revealed the fact that the pressure on every square inch of the body of a creature at that depth is more than 20 times greater than the pressure in the average locomotive boiler.

From all this experience men for a long time believed that there could be no life down in the black

ocean depths No sunlight ever reaches more than a few hundred feet below the surface, and where there was no sunlight, it was argued, there could be no plant life Where there was no plant life there could be no animal life, and so the great floor of the ocean, it was reasoned, must be a desolate region of emptiness and death But then a strange thing happened A telegraph cable in the Mediterranean broke at a depth of more than 7,000 feet, and when the broken ends were raised it was found that the cable was overgrown with an astounding variety of living creatures It was certain that they had been alive in the dark and icy cold of the sea bottom, with tons of water bearing down upon them

Fetching Up Life from the Sea Bed

Now men have devised new means of reaching the ocean depths They let down nets and iron hooks, instruments for measuring the temperature of the water, and bottles which open when they touch the bottom, fill with water there, and then close so that water at higher levels cannot enter They make great nets which touch the bottom of the sea and close up tightly as soon as they are raised above the floor, in these nets it is possible to bring up from the bottom countless living creatures from a realm that no man has seen They let down weighted plummets with a sticky substance on the base, which brings up a sample of the ocean bed

And what men find is that in this kingdom of the deep sea—a kingdom of darkness and almost freezing cold—is a great variety of life The floor of the sea, it may be said, is a menagerie of animal life—for there are no plants at the great depths, where the light essential to such life is completely absent Most deep-sea creatures are more or less blind, or have enormously enlarged eyes, and almost all are more or less phosphorescent There are, indeed, myriads of tiny living lamps that swim about illuminating the ocean bed

Explorers declare that on some parts of the floor of the sea there are millions of little creatures that shine like glow-lamps, and the discoveries that have been made in this direction are among the most interesting of all The phosphorescent light of deep-sea creatures—like the light of the glow-worm—is made without waste of heat Even some sharks are able to light up their paths through the deep sea with a white and heatless radiance Certain glands in their skin give out a sticky substance, and it is this substance that makes them shapes of living light It is doubtful, however, if the shark ever penetrates to the deep ocean beds, and it is the deep-sea animals which are most phosphorescent

Animals can live under the great pressure of the deep sea because the pressure inside their

bodies equals the pressure on the outside A tin can could never be crushed by pressure from without if the pressure outward on the inside was equal to the pressure inward from the outside

But though the inhabitants of the ocean abysses are able to live under an enormous load of water, they are liable to extraordinary accidents If, in searching for food, they rise a considerable distance above the floor of the sea, the gases of their swimming bladders expand under the reduced pressure, and they become lighter Up to a certain point the muscles of their bodies can resist this strange tendency to go floating upwards, and the deep-sea fish that has not completely lost control of itself can win its way back to its home in the dark, cold, heavy water If, however, it travels too far towards the world of sunlight, its muscles are not strong enough to drive the body down The fish continues to swell, and is gradually killed in its long and strange voyage to the surface of the sea Thus the deep-sea fishes are exposed to a danger that comes to no other animal in the world—the danger of tumbling upwards! That such accidents do occasionally occur is shown by the fact that some unknown kinds of fish, now known to be deep-sea forms, were found floating dead on the level of the ocean long before men dreamed that life could exist at such depths When brought up suddenly from great depths, animals sometimes explode because of the expansion of gases within the body when pressure from the outside is greatly reduced, and this adds to the difficulty of finding out what these creatures of the great depths are really like

Pastures of the Deep-Sea Animals

The great problem which has perplexed the explorers of the deep sea for many years is the question of how life is maintained so far below the waters What do the creatures of the abyss feed upon? It is clear that they cannot keep up life merely by eating one another, although all but the smaller forms of really deep-sea fish are actually carnivorous Yet, basically, all animal life must have plant life to feed on This is as true of the wild strange animals of the deep as of the cattle of our pastures But we have seen that no ordinary plants can grow in the sunless underworld of water How, then, is animal life maintained there? A few years ago no man was able to answer this question properly, and it was not until great progress had been made in the study of the microscopic forms of life that the secret of the ocean abyss was fully revealed

We now know that in addition to the conspicuous inhabitants of the ocean which can be seen with the naked eye, the waters teem with swarms of microscopic creatures According

OCEAN MARVELS SEEN THROUGH THE MICROSCOPE



This looks like a photograph of strange monsters. Actually, it shows what the microscope revealed in a rocky pool, in a spot only as large as the small square at the left. Most of these creatures are so small that the naked eye could not perceive them. But a powerful microscope reveals them in all their fascination. With the aid of modern instruments we are gradually learning more and more about all the strange forms of animal and plant life in the seas, and to read the story of evolution—a story which began hundreds of millions of years ago in ocean waters. It is from creatures such as these that scientists are slowly putting together the story of how higher forms came into existence, for many of them are the present-day descendants—practically unaltered in forms and habits—of the first forms in which organized animal and plant life appeared on our planet. Truly, the ocean is a fascinating book of life, when even little drops of water hold such wonders as these.

to their general habits, all marine organisms can be placed in three groups. The *benthos* comprises plants and animals which live on or are attached to the sea bottom. Such, for instance, are the rockweeds and corals, and many of the worms and molluscs. Organisms which live in the water itself, like the fishes, whales, and seals, and move about actively from place to place, are the *nekton*. Still other forms—most of them of microscopic size—which float about passively, drifting here and there at the mercy of the tides and currents, are known as the *plankton*. This last group of plants and animals was practically unknown until the middle of the last century, but we now know that it is the primary and all-important group upon which all other ocean animal life depends.

A traveller over the sea may think he is sailing through an almost barren waste of waters because no life may be visible. But let him draw a fine net of silk through the water and examine the catch of "soup" under a powerful microscope and he will be astonished at the wealth of life which is revealed. He would see *diatoms*, which are single-celled algae encased in a glasslike box, so graceful and varied in shape and so delicately ornamented that no artistic jewelry of the finest manufacture could surpass them in beauty. He would see protozoa, too, with elegant shells of mineral material, strange larvae of all sorts, tiny crustacea, and many other forms of life which only an expert could recognize and name. Minute as are these organisms, many others yet smaller he could not see because they escape through the meshes of even the finest net.

Plants the Sea Creatures Feed On

Now, it is these diatoms and other green plants of the plankton which make the sea a pasture. They are to the fishes and other animals of the ocean what grass is to the cattle in the fields. They live in the surface waters, and especially in the shallow water zone where they can use the sunlight in building up their bodies. They are like little chemical factories, employing the heat and light of the sun in making food from the minerals dissolved in sea-water. They multiply at an astonishingly rapid rate and form the basic food for all other ocean animal life. Even when they die their bodies fall into the depths of the ocean and provide food for the animals there, that, indeed, is partly the answer to the question of how the smaller deep-sea creatures get anything to eat.

The value of the diatom does not end with death. Its crystalline case endures for millions of years. Through ages past diatom shells have accumulated on the ocean floor in immense deposits. Great geological convulsions have frequently raised these ocean beds and they have become dry land. Moreover, the strata

thus produced are actually valuable soils for a variety of purposes.

The life of the oceans is most abundant in the surface waters down to about 600 feet, is less abundant in the intermediate depths, and becomes more plentiful at and near the bottom. A whitish or greyish ooze covers about a third of the ocean bottom, and there are vast areas of red clay formed by the decomposition of shells and by pumice and other volcanic materials, and of wind-blown dust. These and other types of clay and ooze are also distributed according to the depth of the ocean floor, and a certain type may be expected in certain districts and at certain depths. There are extensive "continental shelves," over which the water is shallow, covered with gravel, sand, and silt carried to the sea by the thousands of rivers which ceaselessly pour their floods into the oceans.

Some Astonishing Sea Statistics

If we consider merely the quantity of living matter in the oceans, the brain reels before it but a few figures help us to realize it. It was estimated a few years ago that in the North Sea were 10,000 million fishes, and there is a record of a fishing fleet that once ran into a school of mackerel that was fifty miles in circumference.

What helps us most to form some notion of the number of fish in the sea, however, is the number of eggs that fishes lay. Even a sprat deposits about 5,000 eggs, and in the roe of a female cod are found some 8,000,000 eggs. A common herring lays about 25,000 eggs, and a lug babbit 3,500,000, while the turbot is authoritatively calculated to lay no fewer than 14,000,000 eggs. Imagine the number of fishes laying eggs at this rate, and one might think that the products of the sea are inexhaustible. But even so proper methods of conservation are needed.

The principal circulation of the ocean waters is maintained by three factors: (1) winds, (2) unequal temperatures, and (3) variable saltness of the water. Of these three factors the winds are the most important, and are the chief cause of ocean currents. In equatorial regions the prevailing winds over the ocean are easterly winds, and the equatorial waters are drifted westward under their influence. As this moving surface water strikes the continents—as, for example, South America—it is divided, a part of it being turned northward and a part southward. That turned northward becomes the Gulf Stream of the North Atlantic. The corresponding current in the Pacific Ocean is the Japan Current. These warm currents of ocean water moving northward warm the air over them, and in middle latitudes this warmed air is carried over to the continents on the east sides of these oceans, because in these latitudes the prevailing winds blow from the west. This

THEY CARRY THEIR SEARCHLIGHTS WITH THEM



Scientists have thus far, in spite of all their knowledge, been unable to produce light without at the same time wasting much energy in producing heat. Man could save millions if these fish that dwell in the great ocean depths would teach him the secret of their phosphorescence. It seems strange that many deep-water fish thus always carry a light with them when many other varieties have not even eyes.

is one of the reasons why Scandinavia and Alaska are so much warmer than the same latitudes on the east sides of the continents

From the large bodies of ice in the polar regions large volumes of ice-cold water are poured into the oceans. These cold waters move southward along the east sides of continents, but presently sink beneath the surface. These great supplies of cold water from the polar ice keep the temperature of the ocean low. The temperature of the great body of the ocean is below 40°F., though the surface waters, especially in low latitudes, are much warmer.

The warm currents in the oceans give rise to

fogs, which are very troublesome to navigation. The warm air over the Gulf Stream, for example, is heavily charged with moisture, and when it is carried by the winds beyond the Gulf Stream over colder waters, the moisture in the air condenses into fog.

Pure sea-water is a light shade of blue, but sometimes it is a shade of green or brown, owing to foreign matter or plants and animals floating in it.

The water evaporated from the sea is borne to the land, and some of it is condensed and falls as rain or snow. More than 6,500 cubic miles of water falling on the land is yearly sent back to the sea by rivers, carrying with it salts and earthy matters. The saltiest waters are found where evaporation is greatest—for example, in the Red Sea, and in the trade-wind regions of the ocean basins. Owing to the constant circulation in the ocean, oxygen and other gases of the air are carried down to the greatest depths, thus animals and—to a smaller extent—plants may flourish there.

For sounding the ocean's depths the old-fashioned lead and line is now being discarded for electrical devices, such as the sonic depth-finder and the fathometer, by which the depth can be instantly ascertained. These measure the speed of sound waves through sea-water, and the depth is estimated by the time that is required for a sound sent from the ship's bottom to echo back from the ocean floor. The sounding line, however, can be combined with a graph to obtain specimens of the deposits on the ocean floor. (See also Maine Life)

O'Connell, DANIEL (1775-1847) Throughout the 18th century Ireland was in a very unhappy state. Roman Catholics, the great majority of the nation, were forbidden to take any part in politics, Protestant landlords, most of them in England, lived on a hard-pressed Irish peasantry, severe statutes prevented Irish manufactures from competing with English. In 1782 the Irish Parliament had been allowed real powers, but after the Irish rebellion of 1798 it accepted the Act of Union with Great Britain (1800), under the provisions of which Ireland was left only with representatives in the British Parliament at Westminster.



O'CONNELL, 'THE LIBERATOR'

Because of his championship of the Catholic people of Ireland, then subjected to many unfair laws, the Irish patriot, Daniel O'Connell, became famed as "the Liberator." He was a splendid orator and a born leader, with a great hold over the people. Yet he never incited them to the use of force.

Daniel O'Connell was a successful Irish lawyer, himself a Catholic, who undertook to remedy this condition. He set about uniting the several divisions of the Catholics upon a political programme, which included the right of Catholics to sit in the British Parliament, from which they had been excluded since the 17th century. He gained the support of the priests, and organized the peasantry in 1823 in the Catholic Association, the dues of which were only a penny a month. The people joined by tens of thousands, and the money raised was used to support Irish agitation. Within a year the association became a powerful political force.

It did not matter that the Government passed a bill suppressing the association. O'Connell then formed a new society

avowedly "for the purposes of public and private charity." Great meetings were held throughout the country. O'Connell ventured to run a candidate for Parliament against the powerful Beresford family, and beat them. An eleven days' meeting of the peasantry and of Catholics all over the island alarmed the Government.

The Duke of Wellington, who had consistently opposed the Irish claims, now as Prime Minister agreed with Sir Robert Peel, his chief colleague, that it was better to give the Catholics practically complete rights of voting and holding offices than to risk war. Thus they did by the Catholic Emancipation Act of 1829, a measure which greatly angered many of their Tory supporters.

But Catholic "emancipation," like so many concessions to Ireland, was thirty years too

late Ireland remained unsatisfied O'Connell spent the rest of his life in agitation for a repeal of the Act of Union, that is, for the restoration of an Irish Parliament at Dublin, or for what was later called Home Rule. He also sought laws which would ensure the rights of the tenants against their landlords, and relieve Catholic peasants of the obligation of paying tithes to the English Church. In this last he was successful (1838).

Odessa, Russia. The train rolls through mile after mile of oats and barley and waving fields of golden wheat, until it comes abruptly to the end of the steppes, between the two great rivers, the Dniester and the Dnieper. There, on the brink, looking out over the Black Sea, stands Odessa, the greatest port of the Ukraine Socialist Soviet Republic.

Along its tree-arched avenues and broad boulevards are magnificent houses which were once the homes of the rich and noble, but are now converted into tenements, sanatoria and holiday-homes, or government offices.

There has been much to sadden Odessa.

The revolutionary fighting of 1917-20 laid large parts of the city and suburbs in ruins, and the famine year of 1920-21 caused keen suffering. Trade fell off tremendously after the World War. Odessa had been one of the world's busiest seaports, and was the commercial capital of south Russia. Although the government has spent vast sums improving the harbour and quays, the old time prosperity has been slow in returning. But it is still an important intellectual centre and is the seat of a university.

Besides its activities as a port, Odessa has shipbuilding, metal, glass, oil, agricultural machinery, and cork industries. The exports are chiefly grain, linseed, timber, wool, and cattle. There are air services between Odessa and other Russian cities.

Catherine the Great founded the city on the site of an old Turoo Tartar village in 1794, as a stepping-stone towards Constantinople. The population today is about 604,000.

Odin. When the long dark winter evening settles down on the Northland, the children gather round a great pine-log fire and listen to Grandmother's wonder tales of Odin, father of the gods of Scandinavian mythology.

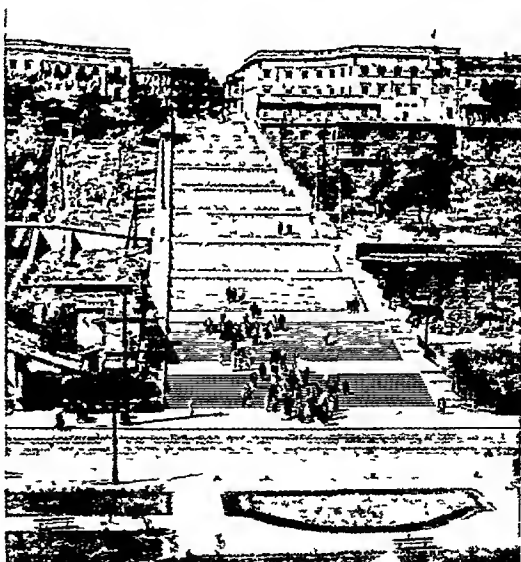
Many, many years ago, the story runs, there arose from the centre of the earth a lofty mountain, so high that it reached to the clouds.

On the top of this mountain was a beautiful green plain, in the midst of which stood the shining city of Asgard, home of the gods.

Chief among these gods was Odin (sometimes called Woden), who sat on a golden throne in the centre of the plain, and directed the wind, the rains, and the seasons. On Odin's head was a shining helmet, and in his hand he carried a spear made from a bough of the great ash, Yggdrasil, the tree of life.

Though Odin ruled over the heavens, the earth, and the underworld, there was one place that he could not control. This was Jotunheim, the home of the frost giants; a dreary frozen country that lay to the north beyond the seas. These giants waged unceasing warfare against the gods and men, and Odin longed for the wisdom that would make him greater than any of the giants and enable the gods to triumph over them.

The only way in which this wisdom could be acquired was by drinking from the fountain of knowledge. Mimir, an old, old giant with snowy beard, guarded the sacred fountain.



ODESSA'S STREET OF STEPS

One of the chief ornaments of the Russian city of Odessa, in the Ukraine, is a beautiful boulevard that runs along the sea-coast. It is approached from the lower town, which is 120 ft. above sea-level, by this magnificent flight of steps. Odessa is now one of Russia's chief pleasure resorts.

ODIN BEGS A DRINK FROM THE SACRED FOUNTAIN



Odin, already the ruler of the heavens, the earth, and the underworld, seeks the wisdom which will also make him more powerful than any of the giants of Jotunheim. With him are the black ravens, Huginn (Thought) and Muninn (Memory), who kept him informed about happenings on the earth.

and none could drink of its waters without his consent. When he saw Odin approaching he said: "What does the father of the gods seek so far from sunny Asgard?"

"I have come to beg a draught from your well, O Mimir," answered Odin.

"Whosoever drinks from this fountain," said Mimir, "must be willing to give much in return."

"I will give whatever you ask," replied Odin. So Mimir handed him a drinking horn, saying: "Drink, then, and the wisdom of the ages shall be yours, but you must leave me one of your eyes."

Odin thereupon drank, and forfeited his eye, and ever after there was no one in all the worlds who could compare with him in wisdom.

Though Odin was really the god of the heavens, he was ruler of the earth as well, and it was he who created men and put them on the earth, teaching them to fish, hunt, and till the soil. Being a warlike god, he also taught them to fight gloriously in battle, and he sent his messengers, the Valkyries, or battle maidens, to lead the souls of heroic warriors who had fallen in battle to Valhalla, the hall in heaven of the gloriously slain.

The fourth day of the week is still named Wednesday, or "Woden's day." Odin is sometimes identified with the Roman Mercury, which explains why the French call the fourth day of the week *mercredi* ("Mercury's day").

HOMER'S HERO—the Crafty ODYSSEUS

Known to us better, perhaps, by his Latin name Ulysses, the Greek hero Odysseus occupies a position of great importance in literature and legend. Below, his story is recounted in thrilling fashion.

Odysseus. (Pron o dis'-ūs) One of the greatest of the Greeks who warred against the Trojans was the hero Odysseus (later called Ulysses by the Romans). He was king of the rugged little island of Ithaca, off the west coast of Greece, and, when summoned to join his brother chieftains, was unwilling to leave his fair young wife Penelope and his little son Telemachus while he went to battle in a foreign land. In order to escape he feigned insanity. When the prince Palamedes came for him, he found Odysseus with an ox and an ass yoked together ploughing the sand on the seashore, which he had sown with salt. But Palamedes took the baby Telemachus and laid him in the line of the furrow where the ploughshare would strike him. Odysseus quickly turned the plough aside, thus showing that his insanity was make believe.

When Odysseus saw that he could no longer refuse to go to the war, he lent his aid to bring in other reluctant chiefs, among them the great

Achilles (*g v*). He fitted out twelve ships for the expedition, and during the war distinguished himself as the wisest adviser of the Greeks, as well as one of their bravest fighters. Well did he deserve the title of "the crafty Odysseus." It was he who devised the stratagem of the wooden horse, and he was one of the men who hid within it and thus captured the city of Troy (See Trojan War).

When the war was over, Odysseus with his twelve ships laden with treasures from the conquered city set sail with a glad heart. It was ten years since he had left home, and he hoped now for a speedy return. But the gods willed otherwise. Little did he dream that ten years more would pass before he saw his dear wife and child again. The story of the return journey of Odysseus, of the adventures of this "much-enduring man" and his infinite resources and stratagems, is told in Homer's great epic poem called the *Odyssey*. (See Homer)

Some Adventures of Odysseus

ADVERSE winds had sent Odysseus' ships wandering over the deep, and driven them to the south, far out of their course. After many days land was sighted and the waves rolled them shoreward.

The men that Odysseus sent ashore for water found an enchanting land, and friendly people who gave them the fruit of the lotus to eat. This fruit had such magical sweetness that it made the eaters forget their commander and the waiting galleys. Forgetting, too, their wives and children and native land, they wanted only to stay, eat that delightful food, and live in a blissful dream for ever.

When Odysseus learned how his men had been put under that spell of forgetfulness, he went ashore with the rest of his crew. Binding the dreamers hand and foot, he carried them back to the ships. Then he spread the sails, the rowers plied the oars, and he fled from the land.

The stories of Odysseus' narrow escape on the island of the Cyclopes, and of how he overcame the enchantment of the sorceress Circe are given under the headings of Circe and Cyclopes respectively. After these strange adventures Odysseus and his men neared the island of the Sirens. These were the treacherous sea nymphs whose sweet singing lured mariners to destruc-

tion on the cruel rocks of the island. Odysseus well knew his peril, for he had been forewarned by Circe.

The winds abated, the sea fell quiet, the very air was so still that it seemed as though the gods in heaven listened for that celestial harmony. Odysseus stuffed the ears of his men with wax, but, wishing to hear their singing himself, and yet to escape with his life, he had himself bound to the mast. Then he ordered his men to row with great speed past the island where the fair wicked sisters twain sat on the green mead and sang.

He knew that if he was lured to their land, his bones would whiten in the grass at their feet. Yet such was the charm of their voices that when their clear-toned song reached his ears he begged and commanded his men to loose him. But they, strictly obeying his first orders, hounded him yet more securely. And they never stopped rowing until that fatal shore was left behind.

The Peril of Scylla and Charybdis

Odysseus had not gone another hundred leagues before he faced another peril, against which Circe had warned him. When he saw smoke above a mountain peak, heard a yelping as of dogs, and the rushing of waters in a whirlpool, he knew that his galleys were nearing the Straits of Messina, between Sicily and Italy. There the sea hoiled and roared between rocky walls. On one side the sea monster Scylla dwelt in a cliff whose top was shrouded in storm clouds. When a vessel passed she stretched out six hideous heads from her cave and snatched six sailors from the deck. On the other side, across a welter of foam, rose the dread cliff of Charybdis. Here under a fig tree dwelt a still more fearful monster with a huge mouth. Thrice every day she sucked in the sea, and then poured it forth seething like a huge cauldron on a fire. Any hapless passing ship with its men was hurled to ruin; there was no escape.

Choosing the lesser peril, Odysseus steered closer to Scylla. With her terrible long-necked heads, she seized six of the rowers, bore them writhing to the cliff, and devoured them while they shrieked in the death struggle. "And this was the most pitiful thing that mine eyes have seen of all my travail in searching out the paths of the sea," said Odysseus when he recounted the many adventures he had met with.

But still further was awaited them, for Odysseus' men devoured the sacred cattle of Helios, the sun god, on the Isle of Thrinacia, and for this offence Zeus (Jupiter) destroyed their ship by a thunderbolt. All were lost save Odysseus himself, who floated for nine days on a raft, and on the tenth day was cast ashore on the Isle of Ogygia, far off in the western sea.

Here in this land, so fair that even the gods wondered at the sight, dwelt the sea nymph

Calypso in a lovely grotto-palace. Round the cave blossomed a wood of alder and poplar and sweet-smelling cypress, and clusters of purple grapes hung over the entrance. Sparkling fountains mingled their gentle plashing with the songs of birds, and violets carpeted the ground.

But Odysseus had no mind for these pleasant sights nor yet for the sweet singing of the nymph. Eight years he dwelt here with her, sorely against his will, but she loved him and would not let him depart. She would have made him immortal if he would have remained with her. But he refused the boon and ever hesought the gods to relent and let him return home to his beloved island of Ithaca, where dwelt the wife and child he had not seen for so many weary years.

At last Athene (Minerva) interceded with her father Zeus on behalf of the hero, and the father of gods heard her request and sent a messenger to Calypso, bidding her send him thence. The nymph dared not disobey. She gave Odysseus a great axe and tools to build a raft, and with her own hands wove him sails and showed him the star by which he should steer. So the great-hearted Odysseus embarked once more.

But Poseidon, ruler of the deep, was not yet minded to give Odysseus rest from his troubles. Seeing him near the end of his journey, he roused all the winds of heaven against him, so that he was buffeted about for many weary days. At length, when his raft had been dashed to pieces, he stripped off his clothing, and swam for two days and two nights, Athene helping him, until a great wave bore him to shore on the island of Scheria, the country of the Phaeacians, a people like to the gods. Overcome with weariness and faintness, Odysseus crept into a thicket of olive trees, and, lying down on a pile of leaves, fell asleep.

Princess Nausicaa Meets the Hero

It happened that same night that Nausicaa, the fair daughter of Alcinous, king of this land, had a dream in which Athene appeared to her, telling the maiden that her wedding day was near, and bidding her arise at daybreak to wash the garments of the family, that all might have seemly raiment. Early the next morning the clothes were heaped in a high wagon, and Nausicaa with her attendants drove out of the city to the bank of a clear-flowing stream to do their work.

When all the linen had been carefully washed and spread in the sun to dry, Nausicaa and her maidens bathed and dressed their hair. Then they ate and played games.

In a mischievous mood she threw a ball so that it bounded from the rocks and splashed into the river. The girls screamed so loud that Odysseus awoke. They fled in terror as he stalked forth like a lion. He was covered with

salt and natted seaweeds, and for clothing had only a leafy bough which he held before him. But Nausicaa stood firm, for she was the daughter of a king.

"Oh, maiden," the stranger said, "I know not if thou art a princess or a goddess, for never did I see so fair a flower as thou. Have pity and give me a garment to cast about me."

When he had bathed himself, and donned one of her brother's tunics that she had brought to be washed, the stranger gloved with such beauty and grace that all marvelled at him. After the maidens had given him food and drink, Nausicaa bade him follow to her father's palace.

A feast was spread for him in the great hall. When a blind bard began to sing of the Greek heroes of the Trojan war, the illustrious stranger was overcome with emotion. At last he announced himself as Odysseus, king of Ithaca, and companion in arms of Achilles, Agamemnon, Menelaus, and other heroes of that war. There was great excitement, for everyone had heard of the brave, wise, and clever Odysseus, who by the artful trick of the wooden horse had opened the city of Troy.

While a ship was being made ready to carry the hero king home, Odysseus told of the dangers he had come through. Here was the hero of Nausicaa's dreams, but he was not for her. With her heart swelling in her breast she stood, tall and pale and lovely, by a silver pillar, and listened to his tales.

"Farewell, stranger," she said, with a touch of sadness at the thought that she would never see him again. "Remember me for a time, because thou owest thy life to me."

"All my days for overmore shall I do thee worship as a goddess," Odysseus warmly returned. "for thou, lady, hast given me my life."

The next evening the great-hearted king Alcinous put the hero on board a ship and gave him many gifts. And the vessel departed.

Twenty years had now passed since Odysseus had set out for Troy. His son Telemachus had grown to manhood. His faithful wife Penelope still awaited him, never ceasing to pray the gods for his return. No wandering beggar came to Ithaca but she questioned him for tidings of her husband.

When Odysseus had been away seventeen years, suitors for Penelope's hand appeared. Five score and more of the nobles of Ithaca and of the neighbouring islands came with their minstrels and servants, and took up their abode in the palace of Odysseus. Each one hoped to wed Penelope, so that he might rule over Ithaca and possess the flocks and herds, fields and vineyards of Odysseus. Telemachus was his father's heir, he was but a youth, without powerful kindred to defend him. So these insolent intruders wasted the wealth of the absent king, plotted against his son, and persecuted his unhappy queen.

The wise Penelope devised a plan to delude her suitors. She must weave a winding-sheet for Odysseus' age-stricken father Laertes before she could wed again, she said, and so she retired to her chamber and sat at her loom. But the web of her cloth grew not in length, for what she wove by day she unravelled by night. For



"The stranger glowed with such beauty and grace that all marvelled at him."



FAITHFUL ARGUS WELCOMES HIS MASTER HOME AGAIN

"In his beggar's disguise, Odysseus went boldly to the palace. No man knew him. But his faithful dog Argus, worn out by age and neglect, recognized his master and wagged his tail in joyful greeting, just as he was breathing his last."

three years this stratagem stood her in good stead, until her wooers discovered it. More insolent than ever when they learned the trick she had played upon them, they pressed Penelope with increased persistence to make her choice.

But the day of reckoning was at hand, for at last the gods had brought Odysseus safely to his homeland. That he might not be known, the goddess Athene changed him into the form of an old beggar in filthy rags, and in this guise he was received in the hut of Eumaeus, a swineherd, who had been his faithful servant. Thither came Telemachus, who had just returned from a fruitless quest for news of his father. Revealing himself, Odysseus embraced his son with rapture, and then the two took counsel together how they might kill the hated suitors.

In his beggar's disguise Odysseus went boldly to the palace. No man knew him. But his faithful dog, Argus, worn out by age and neglect, recognized his master, and wagged his tail in joyful greeting, just as he was breathing his last.

The unsuspecting revellers received the returned king with insults, ridicule, and violence. When they had departed for the night Odysseus and Telemachus took all the weapons out of the great hall, that the suitors might have no means of defence when the hour of vengeance came.

Then Telemachus departed to his chamber, leaving his father alone in the hall, devising plans for the morrow. Presently the wise Penelope came down to sit by the fire. Long she questioned the beggar, hoping for news of her absent lord. He told her that he had recently seen Odysseus, who was now at last almost home.

Overjoyed, Penelope returned to her chamber. She called the old servant who had nursed the hero in his infancy and bade her attend to the wants of the beggar. As the aged nurse was washing his feet she recognized a scar on his instep and cried out with joy. But the king bade her keep his secret.

The next day the wooers returned to their revelry. After the banquet Penelope took down

the great bow of Odysseus from its place on the wall and declared she would wed the man who could bend the bow and send an arrow through twelve rings suspended in a row

One after another the suitors essayed the feat and failed Only the despised beggar was able to bend the bow and send the arrow to its mark Then, suddenly stripping off his rags, Odysseus leaped to the threshold and sent arrow after arrow whizzing among the panic-stricken suitors The doomed fell thick, one upon another, and when his arrows were spent Telemachus brought him shield and spear With fresh fury the king and his son renewed the slaughter, and ceased not until the last man of the suitors was dead

The bodies of the slain were carried out, the air was made sweet with incense, and Odysseus was clad in his royal robes Then the old nurse was sent to Penelope with the joyful news of her husband's return—*Retold from Homer*

Oedipus. (Pron ē'-di-pus) Perhaps the most tragic hero in Greek legend is Oedipus, king of Thebes His father Laius, king of Thebes, learned from an oracle that his own son should kill him, and he therefore pierced and bound the feet of the new born babe and caused him to be exposed on Mount Cithaeron, in order that he might perish But a kind-hearted shepherd found the child and named him "Oedipus," meaning "swollen foot" The child was brought to the king of Corinth, who, having no heir, reared him as his own son When Oedipus was grown to manhood he learned from an oracle that he was to kill his father and marry his own mother To escape so dire a fate he decided to leave home, for he believed that the king of Corinth was his father

On the way to Thebes he met a chariot in which sat an aged man An attendant who preceded it rudely ordered Oedipus out of the way and a combat followed, in which Oedipus slew both master and servant So the first part of the oracle was fulfilled, for the aged man was Oedipus' real father, King Laius

About this time a terrible Sphinx appeared in the neighbourhood of Thebes (See Sphinx) This monster put to all who passed her a riddle, and forced them to guess it or suffer death Many were devoured, for no one was able to give the correct answer To rid themselves of this terrible scourge, the Thebans offered the vacant throne and the hand of

Queen Jocasta to whoever should succeed in overcoming the monster

"What animal," asked the Sphinx when Oedipus confronted it, "walks on four legs in the morning, on two at noon, and on three at night?" Oedipus replied "Man, for in the morning, the infancy of his life, he creeps on all fours, at noon, in his prime, he walks on two feet, and when the darkness of old age comes over him he uses a stick for better support as a third foot" Thereupon the Sphinx dashed herself over the rocky precipice and perished

Oedipus then became king and was married to Jocasta Soon the country was devastated by a terrible plague The oracle, when consulted, promised relief when the murderer of Laius should be banished Oedipus then learned from a seer that he had fulfilled the prediction of the oracle and killed his father, and married his mother In horror he put out his eyes, while his mother hanged herself Blind and helpless, Oedipus wandered away with his daughter Antigone



OEDIPUS ANSWERS THE SPHINX'S RIDDLE

This painting, by the famous French artist Ingres, shows Oedipus, solving the riddle propounded to him by the Sphinx According to the story those who could not answer her riddle paid for their inability with their lives
The Louvre, Paris photo Allart

The tragic fate of Oedipus descended to his children. After his abdication, his two sons, Eteocles and Polymnes, became joint rulers of Thebes. Eteocles, however, desiring to rule alone, seized the reins of government and expelled Polymnes from Thebes. Thereupon Polymnes repaired to Argos, where he married the daughter of Adrastus the king, and enlisted the latter's help against Eteocles.

Adrastus and the Argive army attacked Thebes with great valour. The loss of life was terrible. Finally Eteocles, grieved to think that all this bloodshed was on his account, offered to decide the issue by single combat with his brother. The duel took place just outside the city walls. Both Eteocles and Polymnes were mortally wounded and died on the field.

Creon, brother of Queen Jocasta, now became king of Thebes. He gave Eteocles burial with royal honours, but decreed that the body of the younger brother should be unburied. Antigone dared to defy the royal edict, and performed the funeral rites necessary to give his soul rest.

The Greek dramatist Sophocles tells the story of Oedipus and his children in the great trilogy of "Oedipus the King," "Oedipus at Colonus," and "Antigone." In this last play he gives a beautiful picture of the noble character of the maiden. When Creon asks "And thou didst dare to disobey these laws?" Antigone replies:

Yes, for it was not Zeus who gave them forth,
Nor Justice dwelling with the Gods below,
Who traced these laws for all the sons of men.
Nor did I deem thy edicts strong enough,
That thou, a mortal man, should'st over-pass
The unwritten laws of God that know not change.
They are not of today nor yesterday
But live for ever, nor can man assign
When first they spring to being.

But Creon was unmoved. Even the pleas of his son, Haemon, who loved Antigone, were of no avail, and she was condemned to die by being buried alive in a cave. Haemon succeeded in entering the vault, but too late, for Antigone was already dead, whereupon he threw himself on his own sword and expired beside the body of his beloved Antigone. His mother, Eurydice, in her grief, killed herself. Thus Creon was doomed to a widowed and childless old age.

For "Oedipus Complex" see Psycho-analysis.

Offaly, COUNTY OF EIRE Formerly known as King's County, Offaly is situated in the very heart of Ireland, covering some 772 sq. miles, with a population of just over 51,000.

It lies almost wholly in the great central plain, except a small part in the south-east where the beautiful Shelve Bloom mountains form the boundary between it and County Leix. The river Shannon skirts the county on the west.

The soil consists largely of bogland and light loam, but the plentiful use of lime fertilizers produces rich pastures on which cattle,

sheep, and pigs are reared on an increasing scale. The main crops are oats, barley, potatoes and rye. There is a large creamery and dairying industry, but there are no manufactures.

The county town is Tullamore (population, 4,000), which lies in the centre of a district rich in historic associations.

Ohio, U.S.A. Of the two great tributaries that flow into the Mississippi, the river Ohio, though shorter in length, is vastly more important than the Missouri, for its navigable waters traverse more than 1,000 miles of the greatest industrial and farming district in the United States, furnishing means of transportation for many of the raw and manufactured products of the region. It serves such industrial centres as Pittsburgh, Cincinnati, and Louisville.

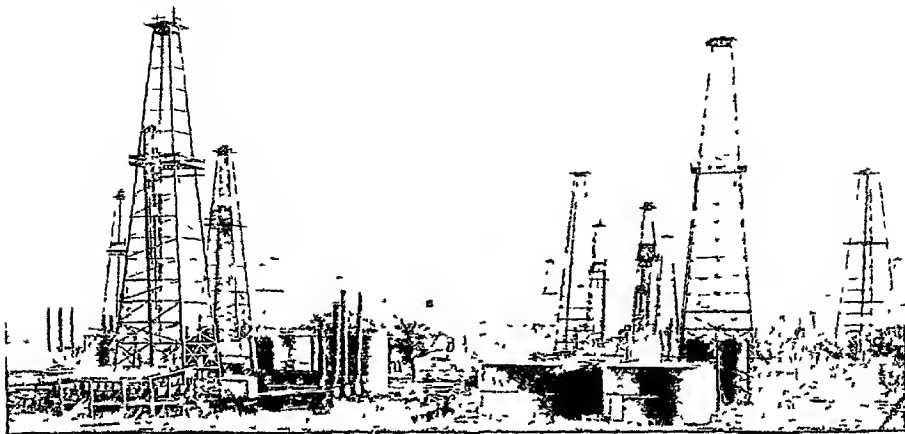
This useful and picturesque river is formed by the junction of the Allegheny and Monongahela rivers at Pittsburgh in Pennsylvania. It flows thence in a south-westerly direction, until it finally reaches Cairo, where it joins the Mississippi. It forms the north-western boundary of West Virginia, the northern boundary of Kentucky, and the southern boundaries of Ohio, Indiana, and Illinois. Its waters are fathered from the numerous tributaries which drain the neighbouring country.

Numerous islands, some under cultivation, divide the waters of the river. Of these the most famous is Blennerhassett, connected with Aaron Burr's conspiracy to establish a separate republic in 1807, near Parkersburg, West Virginia. Formerly the course of the river was impeded by falls, sand-bars and trees growing up from the river bed, and from June to November the waters were too low to accommodate craft of any size. These conditions have been gradually overcome. Canals and locks are built around the falls, the largest of which are at Louisville, Kentucky. Shallows have been dredged, and dams, wing dikes, and channels provide against the drought. In especially dry years, however, low water still impedes steamboat traffic.

The State of Ohio, of which the river of that name forms the southern and eastern boundary, covers an area of 41,000 sq. miles and supports a population of well over 6,000,000. It is above all, a great manufacturing region with enormous coal, iron, and steel resources.

Cleveland (population, 900,000), on the shores of Lake Erie, is the world's greatest iron ore market, and is, in addition, a leading port, railway centre, and manufacturing metropolis. Other industrial cities include Cincinnati (population, 451,000), on the river Ohio facing Kentucky; Toledo (290,000) on Lake Erie; Columbus (290,000), the State capital; Akron (244,000), the "rubber city," and Dayton (200,000), home of the cash register.

OIL OIL speeds the WORLD'S WHEELS



OIL DERRICKS ON THE OUTSKIRTS OF OKLAHOMA CITY

Oil. Sudden and spectacular has been the rise in less than a century of the petroleum business. It has developed from nothing into an industry which now lubricates and turns the wheels of our motor-cars, motor lorries, motor-cycles, farm tractors, warships, passenger liners, motor launches, and aero planes. Yet "rock oil," as petroleum once was called, is no new discovery.

The flaming wells and springs of Baku, Russia, have borne witness to its existence since time immemorial. In various parts of the earth it has issued from the ground or been found in wells or as a scum over the surface of ponds and lakes. The Assyrians, Egyptians, Greeks, and Romans knew of it and made limited use of it as an illuminant, an ingredient in cements, and as an aid in embalming. The North American Indians used it to anoint their bodies and as a treatment for certain ailments, but the usually resourceful American colonists regarded it with deep disgust, or at best bottled it for sale as a medicine, when they encountered it while on prospecting trips drilling for salt.

In 1826 a certain far-seeing Dr. Hildreth ventured the bold prophecy that "this product offers great resources as an illuminating agent, and will certainly become of great utility."

But the odour and smoke of the crude oil made it unsuitable for household use and seriously interfered with the first attempts to market it as a commercial product.

In the '40's kerosene, or "coal-oil" distilled from coal, began to displace whale-oil on the market. Experimenters soon found that a similar illuminant could be obtained by refining petroleum. The resulting demand for petroleum soon outran the supply obtained from brine wells and by skimming the surface of ponds, and a company was formed to bore for oil in Pennsylvania. In 1859 a well driven for this company "struck oil." The first oil boom followed.

Crude petroleum belongs to the group of substances known as bitumens, the members of which may be gaseous, liquid, or solid (natural gas, petroleum, asphalt, and mineral wax or ozocerite), but are all of similar nature chemically. It varies in its colour from almost white through amber and a greenish-brown to black,



GUSHER IN ACTION
The great Cerro Azul gusher in Mexico, spouting oil at the rate of 100,000 barrels a day



WHERE THE WORLD GETS ITS SUPPLY OF PETROLEUM

As the size of the black circles on this map is determined by the relative importance of the producing fields, you can see that the world's greatest known oil reserves are in the United States, Mexico, the northern part of South America, Russia, Persia, the Dutch East Indies, Rumania, and Burma. These are now supplying more than 90 per cent of the world's production. Other producing areas of less importance are in Canada, Peru, Argentina, Ecuador, France, Germany, Poland, Iraq, Egypt, and Japan.

Oil has been found in many other regions where development is only on a small scale or has not yet been started.

and in consistence from a fluidity like that of petrol to a semi-fluid state like that of tar.

Whatever its origin, petroleum now exists in sedimentary rocks of practically all geological formations except the earliest and the latest. Not everywhere or in all formations, however, does it occur in commercial quantities. Obviously, the "oil springs" and other superficial indications which once served as clues to underlying oil are no longer sufficient. Since drilling costs roughly from 30s to £4 a foot more accurate indications are needed. The oil prospector has therefore learned to listen with great respect to the advice of the geologist. The advice of these scientists has reduced the proportion of dry wells driven to about a third of what it was under the older practice of random drilling.

The world's commercial supply of oil is drawn chiefly from the comparatively ancient Devonian and Carboniferous (coal-bearing) formations and the comparatively recent Tertiary. (See Geology.) Oil is often found permeating porous sandstones, with natural gas above and salt water below. It is sometimes sealed into pockets or "pools" by domes of impervious rock, and is often subject to pressure which produces a "gusher" when the reservoir is first tapped. Such oil "pools" are of definitely limited extent.

Oil is found at many levels. The early wells at Baku were scooped out by hand to a depth of

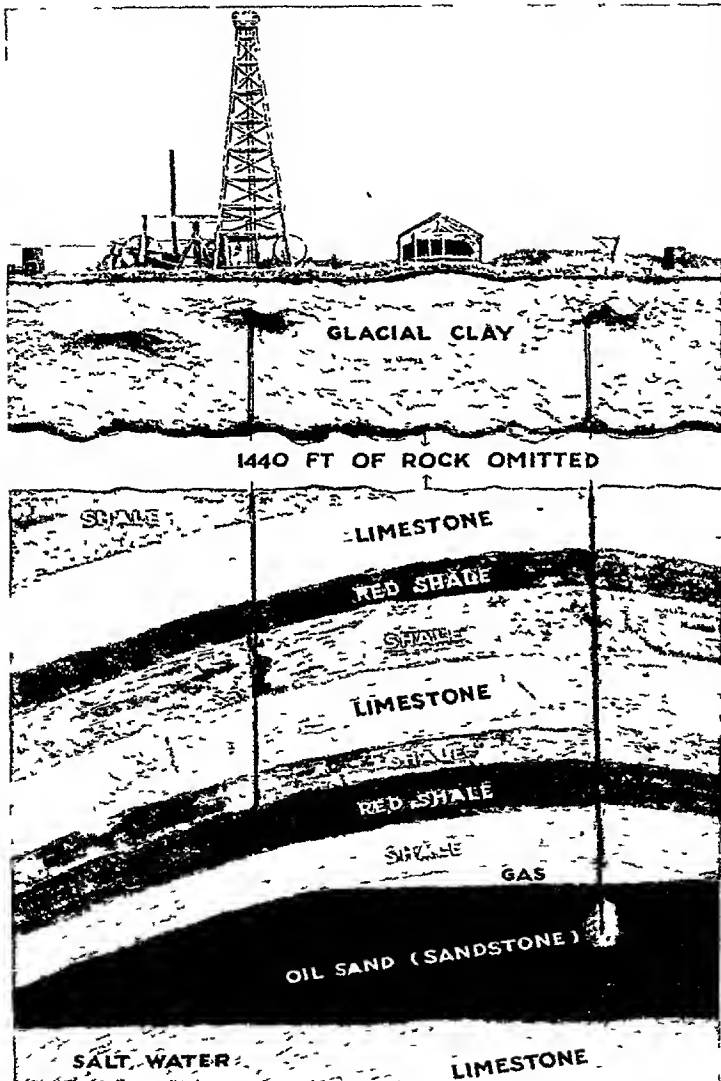
not more than fifty feet. In the United States, productive wells have been drilled to depths of 3,000 and 4,500 feet.

In the United States, the chief oil-producing country in the world, the wells are usually drilled by one or two methods. By the "percussion" or Pennsylvania cable tool method a "string of tools" about sixty feet long and weighing perhaps 1,800 or 2,200 pounds, hung by a cable over a pulley, is raised and lowered at regular intervals with a stroke of three or four feet by a power-driven walking beam. This "string" gradually hammers its way downwards through the rock. Casings of iron pipe are lowered as necessary to prevent the well from filling with water or earth. This method has been found intolerably slow in drilling deep wells through soft caving formations.

The newer hydraulic rotary method makes it possible to reach in a few weeks levels which it would have required months, if not years, to attain by the older method. A heavy drill pipe, fitted at its lower end with a perforated "fish-tail bit," is rotated so as to force a hole through the rock, while water or mud, forced down through the drill pipe, returns outside, thus plastering up the walls of the hole and so strengthening them as to prevent collapse.

If the well proves to be a gusher, much oil may be wasted before it is brought under control,

MODEL IN MINIATURE OF A MIGHTY OIL WELL



YOU can see just how an oil well works by looking at the miniature oil well in the Field Museum of Natural History, Chicago, shown at the left.

The model has two shafts going down through the rock layers. The shaft at the right is completed. It has reached the oil in the porous Kirkwood oil sand at the bottom, a cavity has been made at the foot of the shaft by "shooting" with nitroglycerin, and the oil is being pumped out by the small triangular pump jack at the top of the shaft. These pump jacks are commonly used in Illinois and some other states instead of derricks. This model shows a well in the Lawrenceville oil field of Illinois.

The power to run this pump jack and others not shown comes from the power house in the center. In it is a horizontal wheel, 18 feet wide, and an eccentric which operates rods running to the jacks.

The shaft at the left represents a new well being drilled. Above it is a derrick operating a simple churn drill. A steam engine drives a large walking beam, from one end of which the heavy steel drill and drill rod is suspended. The motion of the beam causes the drill to churn up and down in the well. In the derrick are tools to clean the shaft and pipes for casing it.

Notice how the layers of rock have an upward bend, or "anticline," which forms an inverted basin in which the oil has been caught. It is held there by the upward pressure of the salt water on which it floats. The hard shale above it will not let it escape.

unless careful preparations have been made in advance. But when this happens, the loss is more than balanced by the cheapness of production for some time thereafter. Gushers are frequent in Mexico and Russia. Other wells are called "pumpers."

In the United States three main types of crude oils are recognized—"paraffin base" oils, "asphalt base" oils, and "mixed base" oils.

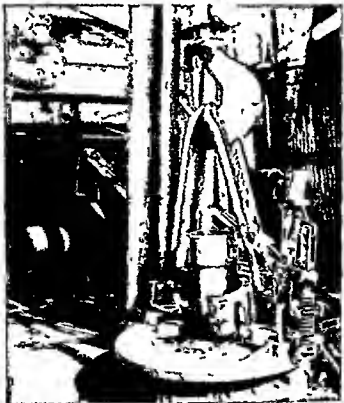
"Fractional distillation" is based on the fact that each component of the crude oil has its own vaporizing point. The light naphthas or petrol constituents vaporize at a temperature which scarcely scalds the skin. If the oil is kept at this constant temperature until all the naphthas have been vaporized, the petrol can be condensed separately. Then the temperature can be raised to the kerosene "boiling point" and held there until the kerosene fraction has been driven off and condensed, after which the heavier fractions are separated. These roughly separated fractions still consist of mixtures, which are then further separated, and the products are put through purifying processes. The naphtha fraction yields aviation petrol and other light naphthas, intermediate naphtha (which is the ordinary petrol used in motor-cars—see Petrol), and heavy naphtha (the "benzene" used in cleaning and in making paints and varnishes). Benzene is now extracted in large quantities from coal-gas by adsorbing it on activated charcoal. The next fractions give, respectively, illuminating oil and "gas oil," used for illuminating purposes. The last and heaviest fraction gives paraffin wax and various lubricants. (See Friction.) Asphalt base oils yield fuel oils, used in firing



These men are raising the drill bit, a giant chisel attached to a long sectional rod which is turned in the boring by means of the circular rotary table through which the rod passes.



Sections of pipe are screwed together to line the well as it is drilled. Here a length of casing is being threaded into place. At the right are sections of the drill rod with threaded ends.



DRILLING AN OIL WELL

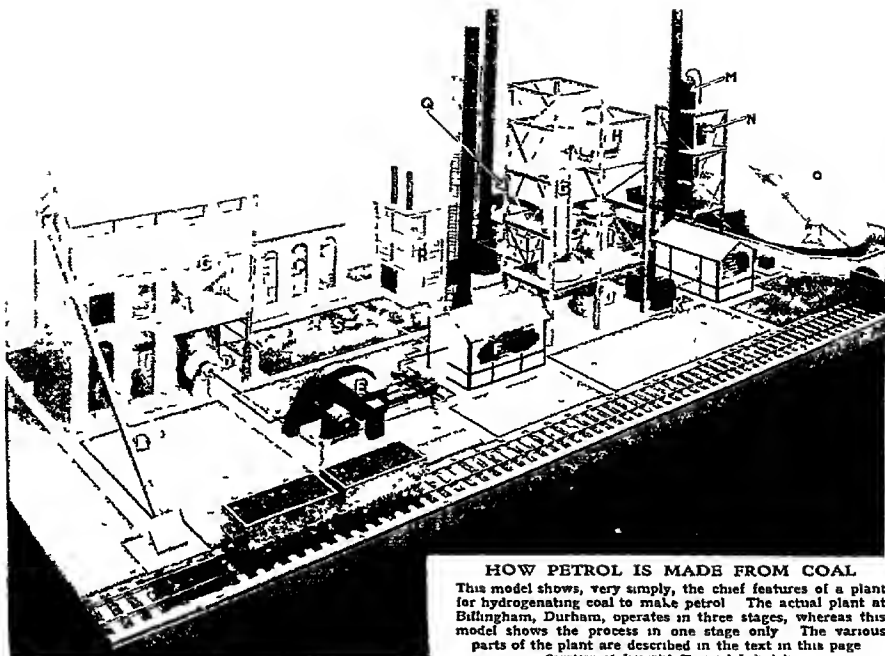
A section of casing has been lowered into place and drilling is about to begin again. At the left can be seen the long chisel-like drill bit, and to the right the gearing to rotate the drill.

steamships, and "artificial asphalt," used for pavings. Vaseline and liquid petrolatum are among the hundred or more minor products of distillation.

Because petrol drives our motor-cars, we are apt to forget the value of petroleum as a lubricant. Oils from petroleum have largely replaced animal and vegetable lubricants. Without lubrication, the whirling wheels of transport would stop, factories would be idle, and food and clothing supplies would be cut off. The first gas-engines made between 150 and 250 revolutions a minute. Engineers declared that that was their maximum speed and that at higher speeds friction would burn them up. Today motor-car engines spin safely at more than 8,000 revolutions a minute.

The "cracking" process makes light naphthas and other hydrocarbons out of the heavy oils by literally splitting the molecules of the latter. The principle of the process was discovered by accident, but chemists have perfected some very ingenious methods based on it. Also the opposite procedure has been tried, namely, forcing two or more small molecules of a gas such as propane to join, making a large molecule of oil.

"Casing-head gasoline" recovered from the natural gas associated with petroleum (called "wet" or "casing-head" gas to distinguish it from the "dry" gas not associated with oil) has likewise become an important factor in the petrol situation. Casing-head gas contains a large proportion of light naphtha vapours. These are recovered by either the condensation or the absorption method, the gas passing through an oil which absorbs the petrol.



HOW PETROL IS MADE FROM COAL

This model shows, very simply, the chief features of a plant for hydrogenating coal to make petrol. The actual plant at Billingham, Durham, operates in three stages, whereas this model shows the process in one stage only. The various parts of the plant are described in the text in this page.

Courtesy of Imperial Chemical Industries

Petrol is now produced from coal by "hydrogenation," in a plant at Billingham (See illustration above). Coal from (A) is taken by a conveyor (B) to storage at C. The mills (D) grind it with heavy oil (S), from the bottom of the "converter" (G), forming a fine paste. Injectors (E) pump this to a pressure of 3,700 lb per square inch through the heater (F), where it mixes with the hydrogen from P, into G, where the actual hydrogenation occurs at 842° F. The products and gases go through the cooler (H) to the "catchpot" (I) which separates the gases and liquids, distributing them to P and J respectively. The pump (K) forces the liquid through the furnace (L) into the fractionating column (M). Petrol is here distilled off and condensed at N before storing in the tanks (O) ready for shipment.

Transport and Distribution

From the operator's "field tank" crude oil is pumped to the "tank farm." Thence it passes into the pipes by which it is transported to the

refineries. These pipes are from two to eight inches in diameter in the field lines where the oil starts, and from six to twelve inches in the main trunk lines. Gravity and pumps are both used. Pumping stations are ordinarily from twenty-five to forty miles apart. The pipe line is much cheaper and more satisfactory than tank cars, and it has almost entirely superseded other methods of land transport in all parts of the world where oil is being produced.

Refined oil is generally distributed by tank railway cars and tank motor trucks. It is shipped in great steel tank steamers, built for the trade and owned by the oil companies. Not only does it save space and labour to use the vessel itself as an oil-container, but the risks of fire are diminished because of the decrease in waste spaces where vapours can accumulate and in surfaces from which leakage and evaporation can take place. A large modern tanker may be more than 500 feet long and carry more than 4,700,000 gallons.

After making petroleum a world industry, the United States became the world's greatest consumer and producer, producing more than half the oil used in the world between 1860 and 1918. Oil is also found in Canada and Alaska.

In Europe the most important oil-fields at present known are those of Gahcia, Rumama, and the Baku region, which, before the World War, made Russia the most important producing nation after the United States. Asia has the valuable fields of Iran (Persia), Iraq, Burma, Borneo, Java, Sumatra, and Japan. China and other largely unsurveyed Asiatic regions probably have oil reserves. Australia's possibilities are little known, so are those of Africa, though there are oil-producing fields in Egypt.

How 'Shell' Got Its Name

The Shell company, one of the greatest of oil combines, was so called by its founder, Marcus Samuel (later Viscount Bearsted) and his brother, Samuel, in memory of the pleasure they had had as boys in collecting sea-shells used by their father (an eastern merchant) in making shell-ornamented boxes for which there was then a big sale. Formed in 1897, the Shell company amalgamated with the Royal Dutch oil company in 1907.

When petroleum was first put on the market, lamp oil was the chief and most valuable product. The naphthas were regarded as dangerous impurities and troublesome waste products. But when the motor industry came into existence, it quickly used up all the petrol available and called for more. Producers and inventors have been busy ever since trying to satisfy this insatiable appetite.

Likewise the navies of the world have found that oil is a better fuel in many ways than coal, and are building oil-burning ships. So also are many merchant shipping firms. Between the two another heavy demand is made upon the oil resources of the world, already taxed by the demands of the motor vehicles and other petrol-driven machines.

From the world-wide need of developing new supplies has arisen a keen struggle, between both companies and nations, to control petroleum fields wherever they may be discovered, particularly in weak or backward countries.

Elaborate plant has been installed in the mining districts of Durham, Yorkshire, and South Wales, and is successfully producing motor spirit and heavy oil from coal. The first test boring for oil in England was made in 1936 on Portsdown Hill, above Portsmouth Harbour, but it met with no success.

Oklahoma, USA For half a century the tide of white immigration surged about the boundaries of the future State of Oklahoma without being able to enter, and then, in 1889,

the Federal government of the USA first opened the gates, and the flood poured in. Until that date the entire country was known as "Indian Territory"—a country reserved as a last home for various tribes of Indians who had been driven from the Southern and Western States. Only a small portion in the centre remained unassigned to them—the original "Oklahoma," which in the Choctaw language means the "Land of the Red Man." Towards this portion of the public domain the whites had long cast covetous eyes.

Today the eastern part of Oklahoma is one of the world's greatest oil regions, with enormous "gushers" and refineries in the area round Tulsa (population, 141,000). The largest city is Oklahoma City (185,000), the State capital.

Physically, the State consists principally of a great shelving plain sloping towards the south. Although now not so valuable as the oil-fields, the farm lands of Oklahoma cover two thirds of the total area of 70,000 square miles. The population of the State is 2,396,000.

Olive. The olive tree (*Olea sativa*) is the Methuselah among cultivated trees, for in ancient olive groves there are found giants 20 feet round and 700 to 1,000 years old. The tree does not come into full bearing until it is 30 years old, and it continues to bear throughout its long life.

The cultivation of the olive began in prehistoric times, and its products, chief of which is the oil pressed from its fruit, were of great



PICKING OLIVES IN THE HOLY LAND

A woman of Palestine is here seen gathering olives, often termed the "meat and butter" of the Palestinian peasant. The olive tree, however, grows in many other countries, for it is common all along the shores of the Mediterranean and is found even as far away as South Africa and New Zealand.

Photo American Colony Jerusalem



RUNNING CONTEST AT THE FIRST OLYMPIC GAMES

In this reconstruction of the Great Stadium in the sacred plain of Olympia we see the culminating moment of the famous foot race. On the right can be seen the Hellenodikai, the umpires or "Judges of the Hellenes." The Stadium which was just over 300 yards long, was used mainly for foot races, while chariot and horse races took place in the Hippodrome.

(After a reconstruction by Ruhlmanns)

importance to the ancient world. The strength and fruitfulness of the olive tree are proverbial, and the olive branch is a symbol of peace and plenty. In Greece it was sacred to Athene, and a crown of olive leaves was the reward given to victors in the Olympic games. Before the discovery of soap, anointing the body with olive oil was extensively practised by wealthy Greeks and Romans.

The olive tree is mentioned in the Bible, and Palestine still has its famous Mount of Olives. One peculiarity of the olive is that it thrives best in soil composed chiefly of volcanic ash.

The olive is a native of southern Europe and Asia Minor. Today, as in ancient times, the products of the olive are of great value for food and other purposes. In the Mediterranean countries olive oil is used as we use butter and other fats for cooking, and it is highly prized everywhere as a salad oil. The inferior grades are used for lighting and for soap making.

Dried ripe olives are eaten in Greece, but in most other countries they are pickled, either ripe or green.

The olive contains as much as 60 to 70 per cent of oil, which gives it its food value. In olive growing communities the people get oil for their own use by crushing the fruit in a press

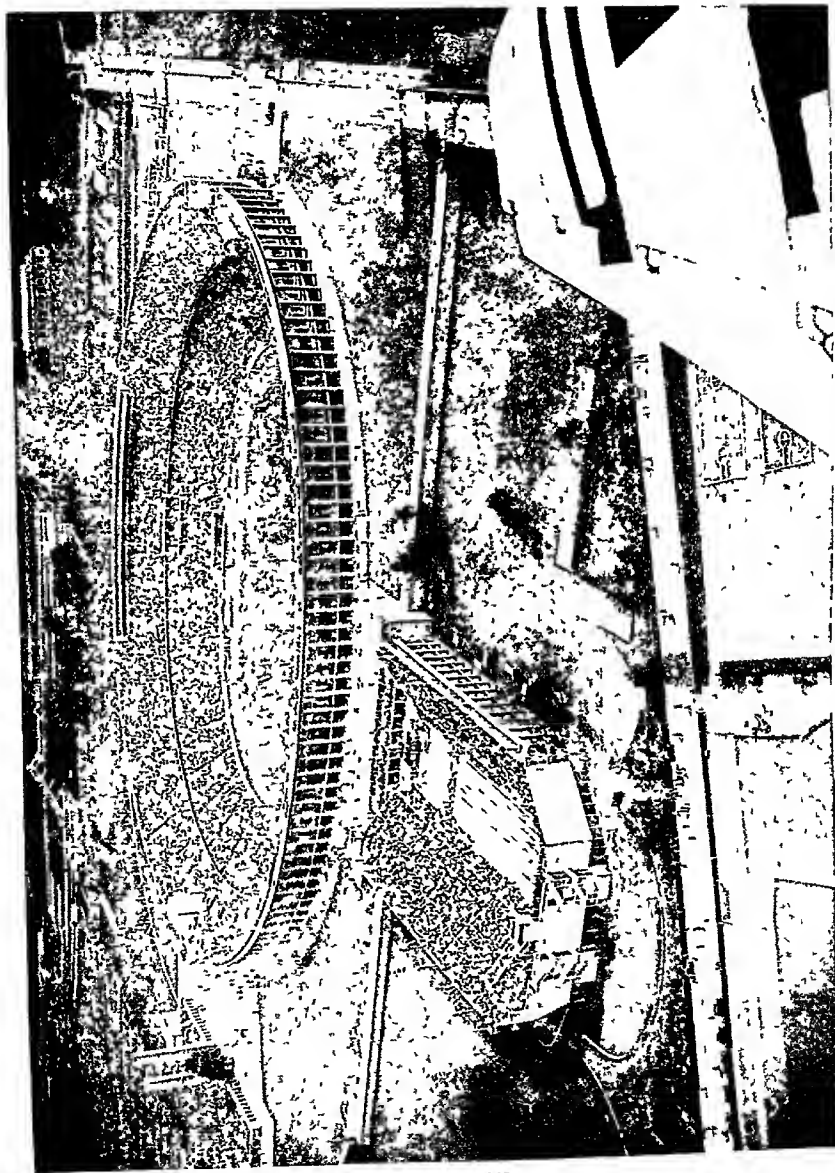
similar to the cider press. For the commercial production large mills are used. Olive oil is not only useful for food, in Greece it fulfils all sorts of other purposes, while even with us it has medicinal uses, makes a fine hair oil and shampoo, and has other domestic applications.

When green olives are picked from the tree they are bitter. To remove the unpleasant flavour they are soaked in lye, and after rinsing are put into a brine solution. Yet, although their flavour is so different, chemical analysis shows little difference in composition between the green and ripe pickled olives.

The wood of the olive tree is very hard and possesses a beautiful grain and colour. The tree, which attains a height of 25 feet, is covered with a grey bark, its evergreen leaves are smooth, thick, and greyish-green above and white underneath.

Olympic Games. The world's most important international contests are the Olympic Games, in which the representatives of every important nation take part. Though in their modern form they date only from 1896, they may be regarded as the descendant of the Olympic Games of the ancient Greeks.

For more than a thousand years these Games were held in July of every fourth year.



GERMANY'S VAST OLYMPIC STADIUM—SCENE OF THE 1936 GAMES

For the eleventh Olympic Games, held at Berlin in August, 1936, a vast stadium was built, capable of holding 100,000 spectators. Some idea of its colossal size may be gained from this aerial photograph. Adjoining the stadium is the large swimming bath, also capable of holding a great concourse of spectators. In the foreground are a track, used for "warming-up" before the events, a football field, and basket-ball pitches. Round about the stadium are grounds for gymnastics, fencing, polo, and other sports, while adjacent to it is a big assembly ground known as the May Field. The whole area is known as the Reich Sports Field.

The whole area is known as the Reich Sports Field.

in honour of Zeus. A traditional list of the victors compiled in later times went back to the Games of 776 B.C., and this date was later taken as a convenient basis from which to reckon time, using as units the "olympiad," or four-year period between the celebrations.

The Games were held in the valley of Olympia in Elis, a natural sanctuary adorned by the greatest artists of the land with statues and temples built in a sacred grove dedicated to the Olympian Zeus. Most magnificent of all the shrines was that of the father of gods himself, in which stood a colossal statue of Zeus wrought of ivory and gold by the great sculptor Pheidias, and reckoned as one of the Seven Wonders of the World.

Events of the Ancient Games

Across the sacred grove, after due sacrifice had been made to the gods, the athletes marched to the stadium, where the contests took place. At first the only event was a 200 yard dash. Later this was supplemented by the *pentathlon*, a fivefold match consisting of running, wrestling, leaping, throwing the discus, and hurling the javelin. Other trials of strength, skill, and endurance were added still later, including boxing and a chariot race.

The prizes were simple wreaths from a sacred olive tree planted, according to tradition, by Heracles (Hercules), the founder of the Games. Thus crowned, the winners marched in procession round the sacred grove, while their admirers chanted triumphal songs written for the occasion by some great poet. When the victors returned to their native cities they were received with extraordinary honours.

As mentioned above, the Games were revived in 1896, to foster the ideal of "a sound mind in a sound body," and to promote international friendship, as the former Olympic Games had done in the ancient Greek world. With the exception of the period of the World War, these events have been held at four-year intervals since 1896, always in some world capital. Teams of picked athletes are sent from all over the world, and in 1936 fifty-three nations competed in the events held at Berlin. More than thirty different branches of sport are represented, including both track and field athletics, rowing, sailing, swimming, shooting, figure skating, hockey, and other games.

Virile Northerners Always Win

It is a remarkable fact that the victorious countries in the revived series of Games have always been found among the Northern races. Thus at first the English athletes did especially well, then the Finns, then the Americans, and, finally, in the 1936 Games at Berlin, the Germans. The post-war series in particular have aroused very keen interest, and many countries, but especially America, Germany, Sweden,

Finland, and Japan, start training their teams for the next series as soon as the last one has finished. In this way, and by concentrating on the events in which they are weakest, these countries have gradually come to the fore, and the happy-go-lucky methods of the British athletes have resulted in less and less success. Most of our athletes are business men and can train only in spare moments. Moreover, most countries have a highly paid and fully qualified permanent coach from one series of Games to the next, who is in fact more or less a "dictator" in the sport which he is controlling. He will see to it that the right men train for the right sports, that they do not overdo themselves or get stale, and that they do not waste time on unprofitable methods. The whole aspect of athletic training, not merely for the Olympic Games but everywhere, has been altered by these methods. The rise of the Japanese, in little more than four years, from a nation whose competition was not taken seriously to one whose representatives were invincible world record breakers, is an example of what Olympic training has done.

It is curious that some countries excel in some events, some in others. Thus, the English have always produced the finest middle distance runners, the Americans are great sprinters and high-jumpers, the Swedes throw the discus and javelin furthest, the Finns are the world's finest long distance runners, and no one can compete with the Japanese in the hop step and jump.

Life in the 'Olympic Village'

The scene at the great Olympic meeting is a unique spectacle. Nowadays it is the practice to build a whole "Olympic village" where all the athletes live, the representatives of each country in their own quarter. Most of the competitors strive to get to their "camp" several weeks beforehand, for it is most important to be "acclimatized" if you are to do well. Each group, living under the management usually of one man, with also probably a non-competing captain, usually takes with it a supply of the type of food it is used to at home, as well as a cook. Such attention to details is well repaid, as may be seen from the fate of the British team at the 1936 Olympic Games in Berlin who, though they remembered to take their own food, omitted to include in their party a good cook. Hence some of the best British competitors were unable to compete, or to give anything like their best form, on account of sickness.

There are also winter Olympic Games, held usually in the winter just previous to the other Games, in some country which provides suitable conditions. In these the contests include bob sleighing, various skiing and skating races, and

figure-skating for both men and women Modelled on the Olympic Games are such events as the British Empire Games held in London in 1934, and in Eastern Europe, South America, and elsewhere there are similar contests

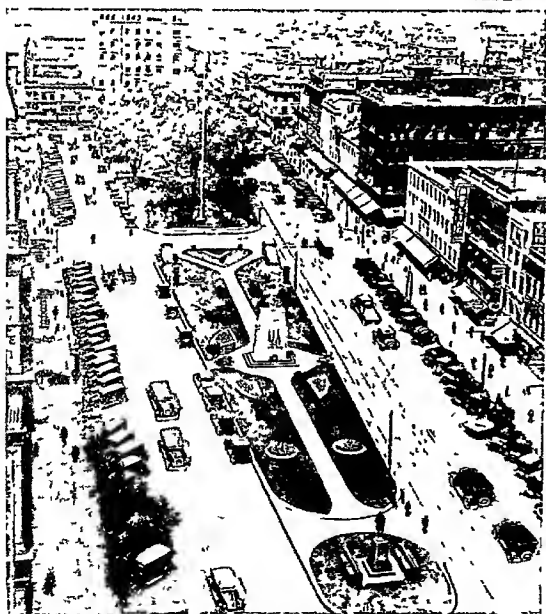
Onion. From the fragrant Easter lily to the humble onion with its pungent odour may seem a far cry, but the gap is not so great as it seems, for both belong to the large lily family The characteristic odour and flavour of the onion come from a sulphurous oil, allyl

The mildest and biggest of the onions are those of the white Spanish variety, which often weigh a pound or more The potato-onion is a form that has several small irregular bulbs instead of a single bulb

Onions have been grown for their edible bulbous roots from time immemorial Their original home is supposed to have been in Central Asia They belong to the same genus, *Allium*, as the milder leek, and the more pungent garlic, both of which are extensively cultivated

in Europe Chives are smaller members of the same genus Shallots have a flavour somewhat milder than garlic

Some of the onions propagate themselves, like other members of the lily group, by bulbils, small bodies borne on the stems or among the flowers and taking the place of the seeds, which often fail to ripen



ONTARIO—ABOVE AND BELOW GROUND

In the upper photograph we see a train of trucks being loaded with ore in the McIntyre Porcupine Gold Mines at Schumacher, Ontario The gallery is no less than 3,800 feet below surface level Below is Gore Park, with its Cenotaph, situated in the heart of Hamilton, Ontario's second largest city

Photos by courtesy of Canadian Official News Bureau

Ontario, CANADA The Province of Ontario may well be regarded as the centre of Canada geographically and politically Lying between the Provinces of Quebec and Manitoba, it connects the old part of Canada with the great new prairie regions of the West, and at Ottawa—an Ontario city and the capital of Canada—is centred the vigorous political life of the vast Dominion

On the tongue of land between Lake Huron and Lakes Erie and Ontario great quantities of grapes, pears, peaches, plums and apples are grown, and the region has become famous for its dairy and meat products This district also makes an enormous quantity of cheese

The province is abundantly supplied with water-power, the chief sources being Niagara Falls, the rapids of the St Lawrence, and the falls of the river Ottawa and its tributaries This cheap power, with the abundance of raw materials and ample transport, have made it the chief manufacturing province of the Dominion

The southern portion is dotted with towns and cities, the most important being Toronto (*qv*), the capital of the province, Ottawa (*qv*), London, Kingston, and Hamilton Numerous railways, both steam and electric, connect

these places and form a network over the region. A splendid system of canals, chief of which are the Sault Sainte Marie, the Welland, and the upper St. Lawrence, gives additional transport facilities.

In the part of Ontario north of Lakes Superior and Huron towns and cities are fewer. Until recently people thought that this land was useful only to the fur-trader and the lumberman, but now it has been discovered that the hardy grizzlies can be tamed, despite the long cold winter, and so this district is being settled by farmers.

But a more valuable source of wealth in this northern region has been found recently in the rich mineral deposits from which come nearly half of all Canada's mineral production. In the Sudbury district north of Lake Huron nine-tenths of the nickel supply of the world is mined. From the Cobalt region come great quantities of silver, making Canada one of the leading silver-producing countries. In the south are considerable wells of petroleum and natural gas. Copper, iron, zinc, gold—in fact, almost

Extent—Greatest length east to west, about 1,000 miles, north to south, 885 miles. Area, 412,582 square miles, including about 49,300 square miles of water surface. Population, about 3,431,000.

Physical Features—Great Lakes (Superior, Huron, Erie, Ontario) and St. Lawrence on the southern boundary. James Bay (on arm of Hudson Bay) on the north. Lakes Nipissing, Nipigon, Lake of the Woods, and numerous smaller lakes. Principal rivers: Ottawa (tributary of the St. Lawrence), Albany, Moose, Attawapiskat, and Severn (flowing into Hudson Bay).

Products—Wheat, oats, wheat, maize, flax, apples, grapes, and small fruit, cattle, sheep, pigs, and horses, fur, butter and cheese, nickel, silver, copper, gold, iron, petroleum, and natural gas, lumber and timber products, iron and steel products, machinery, electrical apparatus, paper and pulp, textiles and clothing, meat products, flour and meal, leather goods and shoes.

Chief Cities—Toronto (capital, about 627,000), Hamilton (159,000), Ottawa (Dominion capital, 124,000), London (71,000), Windsor (62,000).

every useful mineral, including coal—are all found in Ontario.

North of the "Height of Land," which divides the water systems of Hudson Bay and the St. Lawrence, towns disappear entirely, and great forest areas extend over most of the northern districts. Here in winter the lumberer cuts the spruce from which paper pulp is made, the pine for lumber, and the white cedar for

shingles and laths. Through the great trackless forests roams the fur-trader, seeking the other the beaver, and the marten.

After the close of the War of Independence many British loyalists who suffered persecution as "Tories" in the United States settled in Ontario, because they wished to continue to live under the British flag. In 1791 England organized the territory as the Province of Upper Canada. In 1841 it was reunited with Lower Canada or Quebec. Then in 1867 it was again set off as a separate province, under its present name, and became a part of the newly-formed Dominion of Canada.

World-famous STORIES told in MUSIC

If you are unable to appreciate the musical beauty of an opera, you can at least find interest in the story. And this chapter on opera contains the stories of many of the most famous operas.

Opera. Like many beautiful things in our modern world, grand opera had its beginnings in ancient Greece. The great tragedians combined music, poetry, and dance to tell their dramatic tale, the actors would recite their dialogue with special intonations, while with their voices moved the music of lyre or flute, in harmony with the theme of the drama. This was not, of course, grand opera, but from it came opera, centuries later (See Drama, Greek Language and Literature).

The old Greek entertainment was forgotten during the Middle Ages, but then came the Renaissance, and Europe turned back to the splendid, lost, pagan world. A group of cultivated men in Florence, called the *Camerata*, revived some of the old Greek plays, with musical accompaniment, at the aristocratic house of Bardi in 1584. Music, finding new wings in these stirring days, suggested fresh harmonies for this new old entertainment, and

poets supplied new plays. In 1600 the first opera was given in public, Jacopo Peri's musical setting of the poet Ottavio Rinuccini's "Euridice", in this the ancient myth of Orpheus and Euridice was arranged so that the various characters sang the story, accompanied by a small orchestra. The opera had an enormous success and became the model for others.

It is sometimes erroneously stated that the first opera was "Le Jeu de Robin et Marion," by Adam de la Halle, produced in Naples in 1285. This production, however, was nothing more than a pastoral in dramatic form, with the dialogue broken by extraneous ballads, nor was any part of the drama enhanced, interpreted, or accompanied by music. Opera did not begin with this pastoral, but with the efforts of the *Camerata*.

Claudio Monteverde, one of the pioneering spirits of the period, at once recognized the possibilities of the *Camerata's* new plaything,

and made a living work of art out of their previous wooden imitations of the Greeks. His pupil, Pietro Francesco Caletta-Brum, better known as Cavalli, permitted the actors to delay the action and sing a song—the first operatic aria.

In so doing he nearly destroyed opera, for his successors allowed the aria to "run away with the show." For instance, a character, in a moment of great danger, might be made to delay the action in order to sing a long and elaborate solo about his impending peril.

Even Alessandro Scarlatti, who founded the Neapolitan school in the late 17th century, was unable to give drama its proper dominance. He produced the first operas in which all the words were sung, with no recitative.

All forms of Italian art were rapidly spreading to other countries. Opera entered France with the red cloak of Cardinal Mazarin, who brought in his wake a kitchen scullion, Giovanni Battista Lully, who became known as Jean Baptiste Lully. By a rapid rise he became head of the Royal Academy of Music, fostered the ballet in opera, and originated the overture. France was always inclined to emphasize the ballet and the pageantry of opera, Italy the music and the aria, Germany the drama.

The downfall of the ranting and oppressive aria came only with the German, Gluck, in the eighteenth century. Thoroughly disgusted with the Italian operas, in which composers showed off their learning and singers their voices, he stirred up a tempest by writing operas in which choruses and solos were not allowed to bring the drama up short at an awkward moment.

French grand opera, as we have seen, put emphasis on pageantry and the ballet, so much so that these incidental features in many cases overbalance the development of the story. In the 20th century, however, such French composers as Debussy and his followers have given the opera, not only in France but in all Europe, the same tendency to "impressionism" that has marked most recent work in other musical forms.

Side by side with the development of the grand opera proper, a lighter form of music drama has grown up. The humorous Neapolitans, who had never taken the heroes of opera too seriously, introduced between acts lively musical farces, often parodies of grand opera, which they called *opera buffa* (funny opera). In this type of opera the stiff setting adopted in the old classical opera is replaced by an effort to



GREAT MOMENT IN A ROMANTIC GERMAN OPERA

A. Console

Wagner's romantic opera "Lohengrin" is based on a 13th-century German poem. The first performance was given at Weimar in 1850 under the direction of Liszt, but Wagner did not hear it, for he had been forced to leave Saxony for political reasons. This photograph was taken during a performance of the opera at Covent Garden, and shows the meeting of Lohengrin and Elsa on the banks of the Scheldt. This opera has always been one of the most popular of Wagner's works.



A SCENE FROM MOZART'S YOUTHFUL OPERATIC MASTERPIECE

Mozart was only twenty-six when he wrote the delightful singspiel, or opera with spoken dialogue called 'Die Entführung aus dem Serail,' better known today by its Italian title of 'Il Seraglio.' It has been given with great success in recent years at the Glynedebourne Opera House, Sussex, where this photograph of the scene in the garden of Selim's harem was taken. In this opera Mozart created a magnificent humorous character in that of Osmin, the guardian of the palace.

represent more closely scenes of actual everyday life, and the stilted set "recitative" and "aria" are largely replaced by swiftly moving dialogue.

A still further development along this line is represented by the *opera bouffe*, or "comic opera," in which part of the dialogue is spoken instead of sung, and liveliness and bright humour are the chief aims. The work of Gilbert and Sullivan in England, and of Franz Lehár ("Frederica," etc.), Johann Strauss ("Die Fledermaus," "The Bat" for example), and others abroad, has made this the most popular form of opera.

In France opera bouffe became the ancestor of both *opera comique* and *opera bouffe*. Opera comique was not always comic, but differed from grand opera only in having some of its dialogue spoken, not sung. Opera bouffe was farcical, satirical, and light. The work of Offenbach served to crystallize the distinction between them. In Germany, opera bouffe developed, in the hands of the genius Mozart, into fine productions such as "The Marriage of Figaro" and "The Magic Flute." The German opera comique, called a *singspiel*, includes Beethoven's "Fidelio" and Weber's "Der Freischütz."

Great as were the improvements made by Mozart in opera, they had no lasting effect. The

Italians slipped back under the tuneful spell of the interfering aria, though Rossini in the realm of light opera and Donizetti and Bellini in the more serious vein endeavoured to raise the level of operatic standards. Meyerbeer cleverly catered for the romantic taste of the times.

The next great upheaval came from Richard Wagner, whom many regard as the greatest operatic composer of all time. True to German preferences, he thundered with all his strength against the feebly tinkling tune, wrote his librettos on mighty themes, made the music fit the mood, and the drama dominated the entire production. All the possibilities of the instruments and singers (whose voices Wagner often used as if they were instruments) were employed to express the story. To him we owe the *leit motif*, a recurring brief air to symbolize the return to the scene of a certain mood or a certain character. When Lohengrin comes on the stage we hear the Lohengrin theme running in the music, when tragedy draws near, the music hroods.

Wagner's influence was felt in all countries. He had refused to call his later operas by the old name, but termed them "music dramas." Since his time grand opera has been more

sincerely a drama set to music, and less of a musical "grand uproar," as the facetious have sometimes called it

In so brief a space it is possible only to mention a few of the other outstanding names on the long roll of celebrated composers of opera. These include, in France, Charpentier, Gounod, Bizet, Massenet, Saint-Saëns, and Debussy, in Italy, Verdi, Bortolotti, Mascagni, Ruggero Leoncavallo, Puccini, Wolf-Ferrari, and Italo Montemezzi, in Russia, Glinka, Moussorgsky, Rimsky-Korsakoff, and Tchaikovsky, in Germany Richard Strauss. Nowadays, for various reasons, little serious opera is written. The romantic operette (e.g., Noel Coward's "Bitter Sweet") is nearer the public taste.

"The musical comedy" of today, which sprang from the light opera form, has for the most part become a mere series of farcical and spectacular scenes with songs and incidental music interspersed, and can claim no relationship with genuine opera.

The Stories of Some Well-known Operas

Aida (From ah-é-dah) Rhadames, an Egyptian general, loves the captive princess Aida. Through her he unwittingly betrays his country and is sentenced to death. The Egyptian princess Amneris also loves Rhadames, and offers to save his life if he will marry her. He refuses and is placed in a subterranean vault. Aida joins him and there the lovers die.

Music by Verdi. Written for opening of Italian Theatre, Cairo, Egypt, 1871.

Barber of Seville. Count Almaviva tries to win the beautiful and wealthy Rosina whose guardian Bartolo watches her carefully trying to keep her and her money for himself. With the aid of Figaro the barber, the Count wins Rosina, making great fun of Basilio, a music master and marriage agent.

Music by Rossini. Produced Rome, 1816.

La Bohème (From hó-ém) In an attic in the Paris Latin Quarter, four friends live gaily but precariously: Rudolph, a poet, is in love with Mimì, a frail little embroiderer, and Marcel, a painter, with Musetta. The lovers quarrel and part, but are reunited when Mimì, dying of consumption, is brought back to Rudolph.

Music by Puccini. Produced Turin, 1896.

Carmen. The fiery Spanish gypsy, Carmen, is arrested for stabbing a companion, but so fascinates Don José that he allows her to escape. He deserts his old sweetheart, Micaela, and follows Carmen, who, however, transfers her love to Escamillo, a toreador. Don José, maddly jealous, kills her.

Music by Bizet. Produced Paris, 1875.

Cavalleria Rusticana (From kav-al-er-sá rōōs-tah-lah-na) (Rustic chivalry) Action takes place in a square outside a church in a Sicilian town on a glorious Easter morning. Turiddu, a soldier, has just returned from war to find his sweetheart Lola married to Alfio. Turiddu then takes Santuzza, a village maiden, as his beloved, but the jealous Lola wins him back. This leads to a duel with Alfio in which Turiddu is killed.

Music by Mascagni. First production Rome, 1890.

Falstaff. Libretto adapted by Berto from Shakespeare's "Merry Wives of Windsor," with a little material from "Henry IV," featuring the comic, boastful drunkard, Sir John Falstaff.

Verdi's last opera. Produced Milan, 1893.

Faust. Weary of life, Faust, an aged philosopher, is offered youth and power by Mephistopheles in exchange

for his soul. Shown a vision of the lovely Marguerite, Faust signs the compact. He wins Marguerite's love but betrays her. She finally dies in prison, her soul ascending to heaven, and Faust is carried off to the underworld.

Music by Gounod. Libretto based on Goethe's "Faust." First production Paris, 1859.

Hansel and Gretel. Children of a poor broom-maker, Hansel and Gretel go out one afternoon to gather strawberries in the forest near their home. They get lost, and their father, Peter, fears that they have been ensnared by an old witch who entices children into her den and then bakes them into gingerbreads in her oven. When darkness comes on, they are very frightened and fall fast asleep in each other's arms. At daylight they are amazed to see before them a delightful little house made of cakes and sweets. Hungry they nibble at the good things, until the old witch—for it is the witch's house—comes out and takes them both captive. Hansel is put in a cage "to fatten," as the ogress says, but Gretel helps with the preparations. Like a clever girl, however, she remembers the incantations used by the old witch to overcome her brother. As soon as the witch's back is turned Gretel disenchants Hansel, who is thus freed from the cage, and they together after pushing the witch into the oven, their disenchanted and bring back to life all the little boys and girls who had been made into gingerbread. The parents of Hansel and Gretel arrive to find that the old witch herself has been baked into a gingerbread cake.

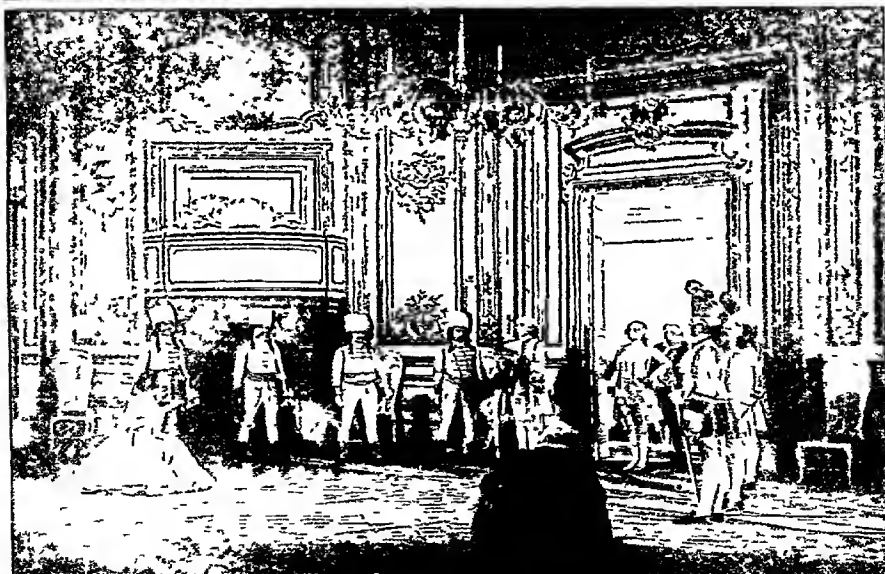
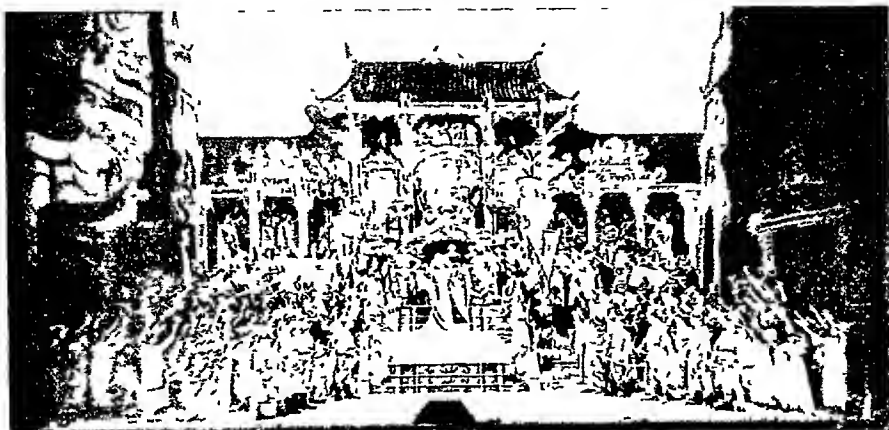
Music by Humperdinck. Produced 1893.

Lohengrin. (From lō-hēn-grin) The young Duke Godfrey has disappeared and his sister Elsa has been accused of his murder. When her champion is called for, a handsome knight in a swan-driven boat appears. He makes one important demand of Elsa: she must never ask his name or rank. On her wedding day, driven wild with curiosity by Ortrud, Elsa asks the fateful question. Before everyone, the knight announces he is Lohengrin, but departs immediately in his swan-driven boat. In grief, Ortrud shrieks that the swan is Godfrey whom she herself has bewitched. Lohengrin is lost to view, and Elsa sinks lifeless to the ground.

Music and text by Wagner. Produced Weimar 1850.

Louise. Louise, a seamstress, leaves home to live with her lover Julien, an artist, in Montmartre, Paris.

GREAT OPERAS OF THE TWENTIETH CENTURY



Puccini died in 1924, before he had time to finish his opera "Turandot," a scene from which is shown in the upper photograph. The work was completed by Alfano, and the first performance was given at La Scala theatre in Milan on April 25, 1926. The lower photograph shows Act II of Richard Strauss's most popular opera, "Der Rosenkavalier." Since its first production at Dresden in 1911 it has become an accepted favourite all over the world.

Photos top Egetone bottom A Console

Heaving her father is ill, she returns home, but her parents reject her

Libretto and music by Charpentier Produced Paris, 1900

Lucia di Lammermoor (Pron lō ch'ā dō lam-er-mōō') By forgiy, Sir Ilon' Ashton forces his sister Lucia to marry Sir Arthur Buoklav for financial reasons. At the wedding feast his lover Edg' appears. Lucia goes mad and kills Sir Arthur, later dying herself

From Sir Walter Scott's novel Music by Donizetti Produced Naples, 1835

Madame Butterfly Sojourning in Japan, Pinkerton, an American naval officer, "ruinches," in Japanese fashion, a Japanese wife, Butterfly (Cio cho san). He sails away for three years, not knowing how seriously she has taken his love. When he returns with an American wife, Butterfly stabs herself

Music by Puccini Produced Milan, 1901

Manon The lovely young Manon elopes with Des Grieux, but, tempted by a nobleman's wealth, she leaves him. Des Grieux enters a monastery, and Manon is finally deported, as an abandoned woman. Des Grieux follows her, and she dies in his arms

Music by Massenet Produced Paris, 1884

Manon Lescaut (Pron les-ko') The same story as above Music by Puccini Produced Turin, 1897

Marriage of Figaro (Pron fr' gā-ib) From the second of Beaumarchais' Figaro comedies, containing similar characters as "Barber of Seville" (see above), this time it is Figaro himself who marries, amid many amusing complications

Music by Mozart (g'r) Produced Vienna 1786

The Mastersingers of Nuremberg (Die Meistersinger von Nürnberg) The young knight Walter von Stolzing becomes enamoured of Eva. He determines to win the Mastersingers song contest the following day in order to obtain her as a bride, although he knows nothing of the rules. Beckmesser, town clerk, a pedantic stickler for rules and himself in love with Eva, opposes him. But Hans Sachs, a cobbler and a genuine musician, sees real inspiration in Walter's singing and favours him. At the contest Walter wins with his glorious *Pearl Song*

Text and music by Wagner Produced Munich, 1869

Mignon (Pron mē-n'ang') A little dining girl, Mignon, is served from her gipsy master by Wilhelm Meister, a travelling student. He allows her to follow him as his page. She is in love with him, but he is enamoured of Philina, an actress. Mignon is injured in a burning castle and is brought to Italy by Lothario, an old musician, who in reality is an Italian nobleman who has lost his memory. In the last act, however, his memory is restored. He recognizes in Mignon his long lost daughter, stolen as a child by gypsies. Wilhelm realises his true love for Mignon and all ends happily

Music by Ambrose Thomas Produced Paris, 1861

Othello Libretto is based upon Shakespeare's tragedy of same name (See Othello) Music by Verdi Produced Milan, 1887

I Pagliacci (Pron pal' va ch'i) (The Players) Opens with a prologue sung by clown Tomo. Camio, leader of a troupe of strolling players, is intensely jealous of his beautiful wife, Nedda, who is planning to run off with Silvio, a villager. In their little play, a similar tragedy of a jealous husband and erring wife is enacted. In the play Camio stabs his wife, forcing her to call upon her lover Silvio, who rushes upon the stage and is killed by Camio who then surrenders, singing, "Applaud, friends, the comedy is ended"

Music and libretto by Leoncavallo Produced Milan, 1892

Pelléas and Mélisande Golaud finds the mysterious Mélisande in the wood and brings her back to the king's castle as his wife. There she and Pelléas, half brother of Golaud, fall in love. Wildly jealous, Golaud asks Pelléas, Melisande, maintaining the innocence of their love, dies in the palace

Music by Debussy Produced Paris 1902

Rigoletto (Pron ri gō-let-tō) The dissolute Duke of Mantua has won the love of Gilda, daughter of the hunchback, Rigoletto. Rigoletto conspires to have the Duke killed, but Gilda sacrifices herself to save him, and Rigoletto is given the assassin's sick containing his own dying daughter

Music by Verdi Produced Venice, 1851

Der Ring des Nibelungen (The Ring of the Nibelungen), a vast musical work by Richard Wagner based on the old legends of the Nibelungs (see Nibelungs, Song of the) The whole work consists of "Das Rheingold," an introduction to the dramas, "Die Walküre," "Siegfried," and "Götterdämmerung"

Das Rheingold (Pron dā-ri-ūn-gōlt) The hideous dwarf Alberich learns from the Rhine maidens that they who would renounce love for ever might steal their treasure, the Rhine gold, and that a ring made from it would render the possessor master of the world. Alberich seizes the gold, has the ring made, also a magic helmet, Tarnhelm. Wotan, father of the gods, takes the gold ring and helmet from Alberich and gives it to two giants to repay them for building the new castle of the gods, Valhalla. Alberich puts a curse on the ring. The giants quarrel and one is slain. The gods proceed to Valhalla

Produced Munich, 1860

Die Valkyrie (Pron dā-ri-ūn-lē-re) (The Valkyries) The Valkyries are nine daughters of Wotan whose mission it is to ride forth each day on flying horses and bring to Valhalla the bravest of the slain. Brunhild, their leader, is Wotan's favourite. However, in a fight between Wotan's earthly son Siegmund and Hunding, Brunhild protects Siegmund against orders. Wotan intervenes, causes Siegmund to be slain, and then slays Hunding himself. Brunhild carries to safety Siegmund's sister-wife, Sieglinde, to whom she gives the fragments of Siegmund's sword. Brunhild is made a mortal woman for her disobedience, and is put to sleep surrounded by a wall of magic fire and destined to become the wife of the first man brave enough to break through the fire and so awaken her

The final act ranks as one of the most sublime in all music with its well-known "Ride of the Valkyries," "Wotan's Farewell" and the "Magic Fire Spell"

Produced Munich, 1870

Siegfried (Pron sē-g-fīd) His mother, Sieglinde, dying at his birth, Siegfried is brought up by the dwarf Mime. He becomes a magnificent hero. From the fragments of his father's sword he forges a mighty weapon. With it he kills Fafner the giant who has made himself into a fierce dragon to protect the magic ring and Rhine gold. Lacking a drop of the dragon's blood, he is suddenly able to understand the birds, and one leads him to Brunhild, whom he awakes. In the meantime, he has met Wotan and fearlessly broken Wotan's spell

Produced Bayreuth 1870

Götterdämmerung (Pron gō-ter-dem'er-ōong) (The Twilight of the Gods) Siegfried gives his magic ring to Brunhild, lovingly bids her farewell, and goes into the world. There Hagen, son of the dwarf Alberich, gives him a magic drink, with which he comes him to forget Brunhild and fall in love with Gutrune, sister of King Gunther. He agrees to bring Brunhild to the king for his wife. Another drink causes him to remember just before he is killed by Hagen. Brunhild learns of the drink and forgives Siegfried. She has a huge pyre built for his body and, with the ring on her finger, rides into the flames. The Rhine overflows and the Rhine maidens seize the ring triumphantly. Valhalla is shown in flames. The world of the gods has passed, and through the sacrifice of Brunhild, the finer era of love begins

Produced Bayreuth, 1876

Der Rosenkavalier (Pron dā-ri-ūn-er-ka-ri-ā-er) The story, depicting the loose moral system of 18th century Vienna, concerns the successful efforts of the young Count Octavian to win Sophie, daughter of the new

OPERA

Ich bin ein Mann. He exposes the vulgar old Baron Ochs to whom Fanniul was trying to marry. **Music by Richard Strauss. Produced Dresden 1911.**

Samson and Delilah. Samson Hebrew leader of gigantic strength is ensnared by Delilah. She delivers him into the hands of the Philistines. In Act III he appears, shorn, blinded, and chained treading a mill praying God for mercy. He is led in shame before the festing Philistines, but praying for strength seizes the marble pillars and overthrows the whole temple.

Music by Saint Saëns. First produced in Weimar Germany, 1877.

Tales of Hoffmann. Opens with a prologue the poet Hoffmann agreeing to tell a group of tavern companions of his three great loves. Story of loves forms the next three acts. All are frustrated by an evil genius that follows him. The first girl is an automaton, the second a mocking coquette, the third a dying consumptive.

In the epilogue he is left alone only the poetic Muse remaining faithful.

Music by Offenbach. Produced Paris 1881.

Tannhäuser. (Pron tahn ho zai) The minstrel knight, Tannhäuser has been enticed into the Venusberg but he wears of the pleasures of Venus and returns home. There he is reunited with his old sweet heart Elizabeth and his old friend and rival Wolfram. But after singing the praises of sensuous love, he is banished, and remorsefully goes on a pilgrimage to Rome. In the end his soul is saved in prayer, Elizabeth and he fall dying on her bier.

Music and text by Wagner. Produced Dresden 1915.

Thais. (Pron thais) The lovely actress and courtesan Thais is converted by the monk Atlanael. But in converting her the monk himself has fallen from grace. To the repentant Thais his dying in a convent, Atlanael comes imploring her to fly to Alexandria. He sinks in despair at her death bed.

Music by Massenet. Produced Paris 1894.

La Tosca. Tosca a singer and Mario a painter are lovers. Mario, by hiding a revolutionist friend is in the power of the malicious Scarpia, chief of police. Scarpia promises to make Mario's execution only a sham affair if Tosca will give him her love. She agrees but stabs him. Mario's execution is real. Tosca commits suicide. **Music by Puccini. Produced Rome 1900.**

La Traviata. (Pron trah vee tah) At a gay party in her Paris salon Violetta, a beautiful woman of bad reputation meets Alfredo. They fall in love. Alfredo's father Giorgio, intervenes imploring Violetta to give up Alfredo for the sake of his family's reputation. She does so, but Alfredo misunderstands, believing her to be fickle. She dies of consumption in the presence of father and son. (Same story as *Dame aux Camélias*.)

Music by Verdi. Produced Venice 1873. **Tristan and Isolde.** Tristan is escorting the Irish princess Isolde to Cornwall to be the wife of his uncle, King Mark. Isolde, unguining Tristan does not care for her. He prepares a cup of poison and invites him to drink. They both drink. King Mark's maid Brangäne has substituted a love potion for the poison and the couple fall under its spell. King Mark discovers them. One of his soldiers wounds Tristan fatally and Tristan and Isolde die together.

Libretto and music by Wagner. Produced Munich 1865.

OPIUM

Il Trovatore. (Pron il tro voh taw ra) (The Troubadour) Manrico the troubadour has been brought up as the son of Azucena. He is really the brother of the Count di Luna, for Azucena stole him as a child to avenge her mother's death. Both the Count and Manrico are in love with Leonora. Finally the Count has Manrico imprisoned. Leonora offers to marry the Count if he will free Manrico. The Count agrees, but Leonora takes poison and dies in Manrico's arms. The enraged Count has Manrico put to death while Azucena, avenged at last, cries "You have killed your brother." **Music by Verdi. Produced Rome, 1853.**

Opium. Late in February the broad flat fields along the river Ganges in India are white, as white as the snowy crests of the Himalayas far to the north to which they seem to reach, for this is the blossoming time of the poppy (*Papaver somniferum*), from which opium is made.

Before the monsoon season of rains begins—for the poppy cannot stand wet weather—



GROWING POPPIES FOR OPIUM

Here is a typical poppy field in India. This plant from which that very important drug opium is prepared, is also extensively cultivated in Asia Minor, Egypt, Persia, and China. Land intended for poppy culture has to be well manured and irrigated, but as excessive rain is injurious to the plant, gathering takes place before the monsoons.

countless half-naked natives squat all day in these fields making little mounds in the apple-green seed pods now fully developed. From two to six different times, at intervals of two to three days, the field must be gone over again, plant by plant to gather the pinkish sticky juice which oozes out of these cups.

For four weeks the gluey mass is exposed on flat dishes to the burning rays of India's summer sun, until evaporation makes it thick enough to be taken to the government factory. There it is weighed, tested, kneaded in deep wooden vats and then made into little balls.

While still quite moist, these balls must be "sunned" again and turned constantly until

they are absolutely dry and quite solid, about October 1. Then the balls are carefully packed in chests and put away in a dry warehouse for a long time. Some day they travel away from India in the holds of great ships, usually on a long voyage round the Malay Peninsula to the ports of China.

The secret trade in opium and its derivatives—laudanum, morphine, and heroin—is one of the great international curses China especially is degraded by its extensive use, and in 1839 she became involved in the so called Opium War (1840-42) with Great Britain. There was another such war in 1855, France and Britain again attempting to secure control of the opium trade, as much for their own profit as for the sake of the people of China. Although the cultivation of the poppy and the smoking of opium have been absolutely forbidden in China by a series of decrees (1906-17), there are places, on river boats and in obscure corners of crowded cities, where the heavy fumes and sickening odour of burning opium can still be ferreted out. Victims of this frightful habit are wrecked mentally, morally, and physically. And this has led to legislation restricting the trade to medicinal uses only. The League of Nations International Drugs Committee has done much to regulate by national agreements the world output of opium.

Though the improper use of opium is such a curse, the drugs derived from it, called *opiates*, are of immense value in the hands of physicians. They are administered to relieve pain and make it possible for patients who are seriously ill to obtain much-needed sleep. While India collects a far bigger yield than other countries, opium is also manufactured in large quantities in Near Eastern countries like Persia, Turkey, Macedonia and Bulgaria.

Opossum. You might not guess that this little American animal (*Didelphys marsupialis*) is a cousin of the Australian kangaroo. He doesn't look much more like a kangaroo than a cow looks like a camel, but both kangaroos and opossums belong to the curious order of *Marsupialia*, or pouched animals. (See Marsupials)

The opossum pretends he is asleep to make his enemy think that he is dead—hence the phrase, "playing 'possum." He tricks his pursuers sometimes by rolling up into a lump ball and lying still. But a pair of bright eyes are watching, and when the enemy is off guard the opossum unrolls and slips away.

The opossum doesn't jump like the kangaroo. All four of his legs are the same length, with

five-clawed toes for climbing. He doesn't walk very well, and he takes to a tree as quickly as possible. His dingy white or grey fur is tipped with brown all over, so it is not easy to see him in a tree. He has a long scaly tail like a rat's, but he can use it as some monkeys use theirs, for climbing and swinging. He has the sharp pointed face of a big rat, the naked ears of a bat, the five-clawed feet of a little bear, and the pouch of the kangaroo, so altogether he is a curiosity.

He makes his nest in the hollow of a tree like a bear, but he doesn't leave the babies at home. Mother Opossum carries them in the pouch when they are small. There are often a dozen or more of them, and they are only half an inch long when they are first born.

When opossum babies are about as big as mice and are old enough to come out of the bag, they like to ride on their parents' backs. There are so many of them that part of the family climbs on the father's back and part on the mother's. There they sit in a row, clinging fast with their claws to the fur and with their little tails wrapped tight around the parent's tail, which is held high over his or her back.

Opossums are found in Central and South America and in most parts of the United States except the extreme north.

Orange. The orange, carrying its golden beauty and fine fragrance and flavour unchanged round the world, is commercially the most important of the fresh fruits. It is a member of the citrus fruit group, which includes the citron, lemon, lime, and grape fruit. Oranges are now available in Britain for the greater part of the year, West Indian fruits being followed



OPOSSUM AND HER YOUNG

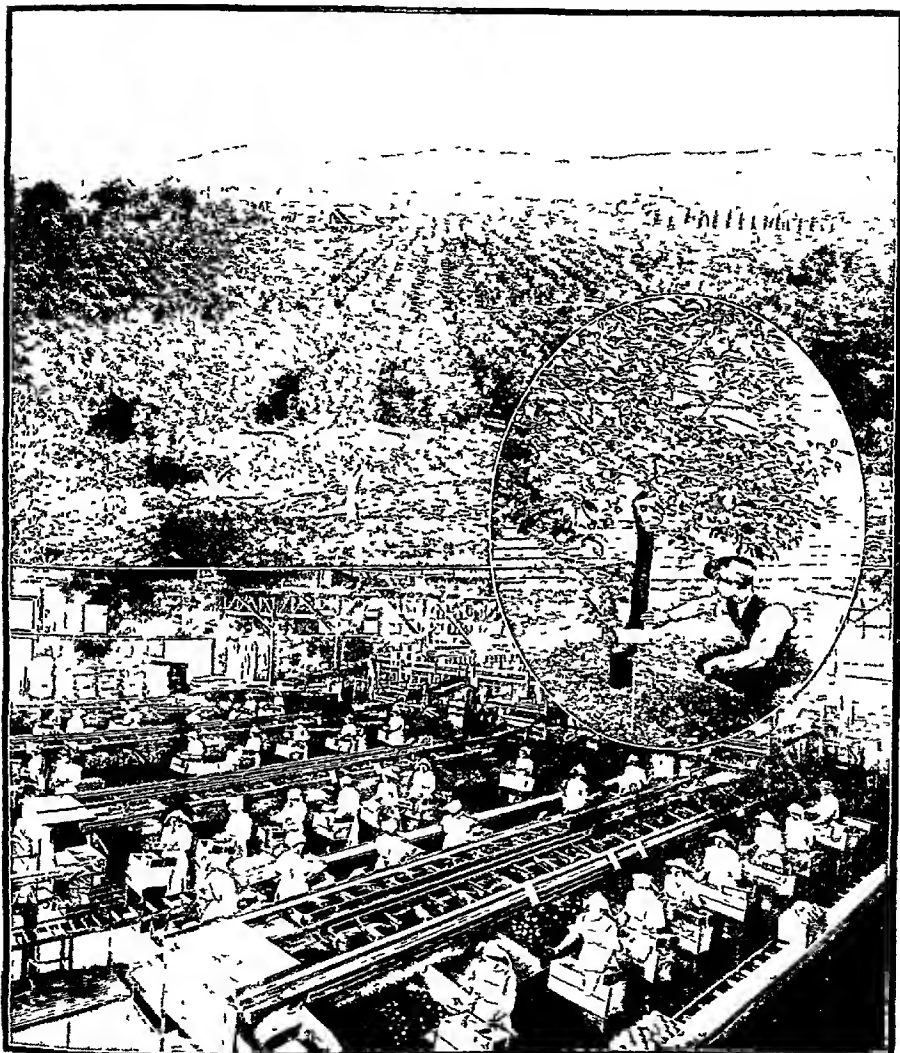
When the young opossums are old enough to leave the pouch in which their mother carries them from birth, they love nothing better than to be taken for rides on her back, sometimes hanging in the most precarious positions

tight around the parent's tail, which is held high over his or her back.

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A VAST INDUSTRY FROM TWO LITTLE TREES



The tree in the oval picture is one of the two original trees from which has been developed the great navel orange industry in the United States. At the bottom is a shipping station where the oranges are sorted and carefully wrapped in tissue paper before they are packed into cases. At the top is a typical California orange grove.

ORANGE

after Christmas-time by supplies from Spain, Palestine, California, and South Africa.

The wild orange was cultivated in early times, and has been carried westward with the march of civilization, each new era opened developing greater importance. Originally a native of eastern Asia, it became a valuable crop in Asia Minor and the Mediterranean regions establishing itself in the sunny mild climate of Italy, Spain, and southern France. The Spaniards carried it to the West Indies, Brazil, and Florida, and the Franciscan Fathers planted it in California. Now South Africa and Australia are important countries producing this luscious fruit.

Orange trees begin to bear when they are about six years old. The best oranges are produced by budding desired varieties on to hardy stock raised from seeds. The trees bear more or less continuously, and flowers and fruits in all stages of development can be found on the same tree at almost every season throughout the year.

The golden fruit and the white blossoms—the bride's favourite flower—and the dark polished leaves make an orange grove very beautiful. The trees are planted in regular rows, and stand from sixteen to thirty feet apart. They require regular pruning, and must be sprayed and fumigated often to destroy the various pests that feed upon them. If there is any danger of frost, too, everything must be in readiness to light fires throughout the groves. In many big orchards a system of alarm bells connected with

the thermometer arouses the sleeping workmen when the temperature reaches the danger point. The fires are built in small wire baskets or pots of crude petroleum, producing a dense warm smoke blanket which keeps the temperature above freezing-point.

But the battle is not over when the crop is ready to harvest. Every precaution is taken against injury to the fruit. The oranges are cut from the bough with scissors, and only very short stems are left, so that they will not injure their neighbours. The pickers wear canvas gloves, for the least scratch may open the way for the germs of decay.

Sorting and Grading the Oranges

At the packing-house the oranges are carefully sorted and graded, wrapped in tissue paper stamped with the name of the firm, and packed in boxes so close that they cannot move. A certain number of oranges of each grade fill a box, about 36 of the largest grade and about 200 of the smallest.

The largest orange of commerce is the seedless, fine-flavoured navel, which has a funny little wrinkled orange no bigger than an olive tucked into the blossom end. It grows in the United States and California.

The best-known varieties of the sweet orange (*Citrus sinensis*) are the Maltese or Blood, the St Michael, the Jaffa, and the Mandarin and Tangerine. Tangerines and mandarin oranges are small, fragrant, and flattened, with loose skin easily separated from the pulp, and the

sections of the pulp come apart easily.

The bitter Seville orange (*C. amara*), an Arabian variety brought into Spain by the Moors, supplies most of our marmalade.

Kumquats are a fruit related to the orange. They are an inch or so long, and make a delicious conserve.

Orange River
AND STATE, SOUTH AFRICA. When in 1486 the great Portuguese navigator, Bartholomew Diaz, sailed down the west coast of Africa on the famous voyage in which eventually he doubled the Cape of Good Hope, he



CAPITAL OF THE ORANGE FREE STATE

Bloemfontein, capital city of the Orange Free State, lies in the centre of a plain flanked by low hills. Its geographical position and its splendid climate have made it a convenient centre for meetings, which include those of the Court of Appeal. It is also a very popular health resort.

The above photograph shows Matland Street, one of the main thoroughfares.

By courtesy of South African Railways and Harbours

came to a part of the ocean in which his two little ships rode on waters of a strange, greenish colour, in which floated vegetation from the distant shore. Though he did not know it, he was off the mouth of South Africa's greatest river—the Orange river, which has its rise in the Drakensberg mountains, eight hundred miles away on the further side of the continent.

Its name has no reference to its colour, but was given it in 1779 by Colonel Gordon, who hoisted the Dutch flag in the middle of the stream and named it after the stadtholder of Holland. In those days the Dutch were the only white settlers in South Africa, having headquarters in Cape Town.

The basin of the Orange comprises 400,000 sq miles of high plateau country, its upper tributaries flow amongst magnificent mountain scenery in Basutoland.

Between the Orange and its tributary the Vaal lies the little country called the Orange Free State, which is one of the original provinces of the Union of South Africa (qv). The first settlers in the region were Dutch, who arrived in 1828. Six years later commenced a great stream of Boers who had left their farms at the Cape because of the decree of the British Government abolishing negro slavery. In their huge wagons the farmers "trekked" with their slaves and cattle for hundreds of miles until, on the other side of the great river, they felt themselves free from the new-fangled ideas of the British.

But there were already many natives in possession of the land—Hottentots, Bushmen, Griquas, and Basutos—and it was some time before the Boers were able to settle down. For a few years, indeed, the British had to intervene to keep order, and there was some fighting between the Boers on the one hand and the Griquas and their British protectors on the other.

In 1854 a Boer republic was set up, and this lasted, under the name of the Orange Free State, until 1900. Then after its occupation in the Boer War it was called the Orange River Colony. But in 1910 the colony entered the South African Union under its former title.

The chief industry is the raising of cattle, horses, sheep, goats, ostriches, etc. There are valuable diamond mines—though these have suffered from a slump in recent years—and some coal. The climate is healthy and agreeable. The rainfall is heavy, but the deep river beds carry off most of the water. Bloemfontein (white population, about 30,000 out of a total of 64,000), the capital and largest town, has the Government offices and a University. Harpersburg, Smithfield, and Kroonstad are other centres.

The population of the Orange Free State was estimated in 1936 to be 771,000, of whom 510,000 were natives.

Orang-utan. (From or-ang'-oo-tan'). The native name orang-outang (*Simia satyrus*) signifies "man of the woods," and is a suitable one, for, like the chimpanzee and the gorilla, the orang-utan approaches Man in appearance and structure.

A full-grown male occasionally reaches a height of 4½ feet, but the outstretched arms cover more than 7 feet. The body is bulky and covered with long, reddish-brown hair. The legs are short but the arms are so long as to reach the



W. S. Herridge

THE ORANG-UTAN'S FEET ARE HANDS

In this picture the orang-utan's feet can be seen supporting it as efficiently below as its hands are holding it above. One hand can be seen with its back and knuckles towards the camera, but the other is above the animal's head and invisible in the photograph.

ankles when the animal is erect, and in walking the knuckles are placed lightly on the ground.

Orang-utans inhabit the swampy forests of Borneo and Sumatra. They are awkward on the ground and prefer the trees, where they can travel rapidly by swinging along on the branches. They feed on fruits and succulent shoots and live in pairs or small family parties.

As a rule they are peaceable, but when disturbed they are fierce fighters. They retreat to

rest at sunset in nests in trees In captivity they are teachable, and the changing expression of the face makes them interesting, though they are not so intelligent as the clumpanzee

Orchestra. The difference between an orchestra and a band is this—when we listen to an orchestra we really hear four “bands” in one! There is the *string* “band,” made up of various members of the violin family, the *wood-wind* “band,” made up of all the wind instruments that are made of wood, the *brass* “band,” with its various kinds of “horns”, and the noisy group of big and little drums, and all the other queer *percussion* instruments that are struck or beaten In Queen Elizabeth's time, before the modern full orchestra was thought of, these sections of instruments were called “consorts” (not to be confused with

concerts) and often played separately Thus Shakespeare's plays refer to a “consort” of viols or “hautboys” All large orchestras also have one or more harps The usual so called “brass” or “military” band includes wood-wind as well as brass

The “strings” form the foundation of the modern orchestra They are capable of the greatest variety of expression in giving voice to the depths and heights of human emotion The violins sing the soprano, the second violins the alto, the violas the tenor, the violoncellos (or “cellos”) the baritone, and the double-basses (or bass viols) the bass (See Violin)

Next in importance is the wood-wind group, which is divided into three families The first family consists of the flute, which with its clear, sweet, liquid notes is the most agile and flexible

of the woods, and the piccolo, a shriller flute, which has been called “the imp of the orchestra” The second includes the oboe, with its plaintive pastoral tone, and the deeper English horn and bassoon, which may be regarded as alto and bass oboes The third comprises the clarinets, which are known by their full, rich, mellow tones There are usually three of these of different pitch Oboes and clarinets, as distinguished from the flutes, are reed instruments

The “brasses” consist of the French horn, which is the old hunting-horn adapted to orchestral purposes, the trumpet, with its full, round, brilliant tone (often replaced by the cornet), the majestic trombone, an instrument of great range and power, and the deep-toned tuba, the bass of the brass band (See Horn, Musical)

Of the percussion instruments, often called “the battery,” some produce “noises” rather than definite musical notes Such are the bass and snare drums, triangle, cymbals, etc., whose purpose is to accentuate the rhythm or add to the volume of sound, or help to produce various descriptive effects (See Drum) The kettle-drums, or *tympani*, however, which are among the most interesting instruments in the orchestra, can be tuned to sound certain notes The bells, “glockenspiel” or “carillon” and the steel plates of the celesta likewise have a definite pitch A large orchestra today contains usually up to about 100 players, although the composers Berlioz and Wagner used to dream of orchestras 400 strong!

The name “orchestra” comes to us from the Greek, in which language the word meant “dancing place,” and the



A PAGE OF AN ORCHESTRAL SCORE

Great orchestral conductors often retain dozens of long scores in their memory, so that they need not watch the music during a concert but may give all their attention to the musicians You can get some idea of what a task this is when you understand that each staff of the score represents the music for only one group of instruments



FAMOUS ORCHESTRA AND GREAT CONDUCTOR

One of the greatest orchestral conductors of the twentieth century is the Italian, Arturo Toscanini, seen above conducting the Berlin Philharmonic Orchestra. Toscanini began his musical career as a cellist. As a member of an orchestra in Rio de Janeiro, in 1886, he filled without rehearsal, the place of a conductor who had been hissed off the platform. He received such an ovation after the performance that he became famous in a night. He has a wonderful musical memory and can learn a score by heart in a single reading.

name came to be given to the players of instruments, because in the old Greek theatre those players used to be placed in the circular space in front of the spectators, where the chorus danced and sang.

With so many instruments playing together it is obviously very important to have a conductor to indicate the time and to preserve the proper balance between the groups. As recently as two centuries ago, when orchestras were still very small, it was the custom for the harpsichord player to lead the musicians without a special conductor. Handel used to do this frequently. How complicated the modern conductor's task is you realize when you look at the many lines of notes on each page of a conductor's score. The leader of an orchestra is the first violin.

There are numerous fine orchestras in the world today. The names of combinations like the Philadelphia Symphony, Vienna Philharmonic, Chicago Symphony, Berlin Philharmonic, Amsterdam Concertgebouw, and Boston Symphony Orchestras are known everywhere, and the music loving public will go to any lengths to watch them "in action" under famous conductors such as Arturo Toscanini, Wilhelm Furtwängler, Bruno Walter, or Sergei Koussevitzky.

In England we have our own large orchestras, like the B B C Symphony Orchestra, conducted at the popular Promenade Concerts by Sir Henry Wood, the London Philharmonic, conducted by Sir Thomas Beecham, and the Halle Symphony Orchestra at Manchester, which was conducted for many years by Sir Hamilton Harty.

The B B C Symphony Orchestra of 119 players is composed as follows: twenty first violins, sixteen second violins, fourteen violas, twelve cellos, ten double basses, five flutes, five oboes, five clarinets, five bassoons, eight horns, five trumpets, six trombones, one tuba, two tympani, three percussion, and two harps.

The smaller municipal orchestras maintained by certain towns—particularly coastal resorts such as Bournemouth or Hastings—now reach a high standard of playing and aim at providing good music for all tastes. (See also Music Musical Instruments.)

Orchid. (Pron *ör'kid*) Fabulous prices have been paid for a single specimen of some of the rare members of this remarkable family of plants. So great is the demand that thousands of pounds' worth of them are imported annually from South America, the East Indies, the Philippines, and even from

Australia And many an eager collector has climbed precipices, waded through malarial swamps, endured all the dangers of tropical forests, and has braved even the head-hunters of Borneo to get these treasured flowers

There are more than 400 genera of the orchid family (*Orchidaceae*), and more than 6,000 species, of which fully 3,000 are under cultivation. They thrive in all parts of the world where it is not too hot or too cold. Orchids are the most highly organized flowers among the monocotyledons.

Some orchids grow upon the ground, and some grow in wet marshy places and live on dead organic matter. The most valuable group are the "air plants" or epiphytes. These plants grow on tree trunks and branches in tropical and subtropical regions, obtaining their nourishment not from the support that some of their roots cling to, but from their long, spongy aerial roots, which absorb water from the moisture-laden atmosphere, storing it in bulbous which grow on the stems.

How Orchids are Pollinated

To botanists orchids are especially interesting on account of their methods of ensuring fertilization. Many of them have a strange resemblance to insects, especially bees, and to spiders, but this resemblance is not necessarily to attract such creatures. Instead of the ordinary arrangement of pollen on two anthers, there are two pollen-bearing bodies, called *pollinia*, which are so arranged that when an insect visits the orchid, it removes these pollinia on its antennae or forehead, they then bend forward on their short stalks, so that when another orchid is visited, they are in just the right position to come into contact with the stigmas, to which they adhere. (See Flowers) If you are clever, you can imitate an insect with a pencil point and prove how this system works with some of our own common orchids.

The typical orchid flower has three sepals and three petals, all of which are brilliantly coloured, often with yellows and reds, sometimes with brilliant hues on a white or green background. The central, lowest petal is called the *lip*, which is often twisted into the most remarkable shapes.

Often, too, there is a long spur at the back which contains the nectar, and such species as have this have a most beautiful scent, an English example of this type is to be found in the butterfly orchids (*Habenaria*), whose lovely white flower you may find in beech woods. Of insect-mimicking forms we have a number, including the bee and fly orchids, while the spider orchids and lizard orchids look strangely like other creatures. None of these is very common, and, like most of our species, they are to be sought in certain places on the chalk downs.

There, also, grows the curious man orchis, which looks just like a tiny little green man on a stalk. Our commoner species include the early purple, spotted, and marsh orchids, while a very strange one is twayblade, so called from its pair of rounded leaves. It grows in dark woods.

Others are the pale brown bird's-nest orchids, which is a saprophyte growing in beech woods, and the lady's tresses, whose stem is twisted into a spiral, the flowers of the latter are very small and are green.

One species of orchid furnishes the vanilla of commercial use, and another the medicinal saloop of oriental countries. (See Vanilla)

Orders and Decorations Today all the great nations reward special valour and patriotic service with decorations of honour, which are often more highly prized than titles of nobility. The wearing of the Victoria Cross or the officer's cross of the French Legion of Honour is indisputable evidence of heroism.

The highest honour which the British fighting man can win is the Victoria Cross, established in 1856. It may be awarded to officers and men of all ranks in the Navy, Army, and Air Force, but only for some signal act of conspicuous bravery in the presence of the enemy. The native ranks of the Indian Army became eligible for it in 1912. So high is the standard set for the "V.C.," as it is called, that during the first 50 years of its existence less than 600 were issued, although Great Britain fought numerous campaigns including the Boer War.

The Distinguished Service Order (D.S.O.) is given to officers for conspicuous merit in time of war, including not only heroism under fire, but also other services in the field. It was founded in 1886, and illustrates a type of distinction quite common in European and other countries, in which the receiver of the reward becomes a member of an honorary order or society. Some of these orders actually date back to the orders of knighthood, founded in the Middle Ages; others, like the D.S.O., are of recent origin. The Distinguished Conduct Medal, given to non-commissioned officers and men in the ranks, corresponds to the D.S.O.

Decorations Created in the World War

The following British decorations were created during the World War: the Military Cross, for commissioned officers of captain's rank or below and warrant officers; the Military Medal, for non-commissioned officers and civilians for acts of bravery in the field; the Distinguished Service Cross and the Distinguished Service Medal, Naval decorations; and the Distinguished Flying Cross and the Distinguished Flying Medal, Air Force decorations, corresponding to the new Army awards.

Membership of the French Legion of Honour is awarded for meritorious service to France.

BEAUTIFUL ORCHID OF TROPIC GROWTH



For variety of shape and colour, as well as for strange habits, the Orchids lead the plant world. The one shown here is a variety of the rosy-lipped cattleya (*Cattleya labiata*). It is found wild in Brazil, growing on the trunks of trees. The flowers, spreading like giant butterflies, are often six inches or more across.



HOW THE ORDER OF THE GARTER IS SAID TO HAVE ORIGINATED

This painting, by A. Chevallier Tayler, depicts the traditional incident at the court of King Edward III from which, it is said, the institution of the Order of the Garter originated. The story goes that the King picked up a garter accidentally dropped by the Countess of Salisbury and handed it back to her with the words "Honi soit qui mal y pense," meaning "Evil be to him who evil thinks," and these words were later adopted as the motto of the Order. The emblem of the Order is a garter, made of dark blue velvet, about an inch wide, with the motto in gold, and worn on the left leg just below the knee.

Photo: Henry Dixon & Son by permission of the artist

The award is made in both military and civil life. A scientist may receive the decoration for some valuable discovery, as well as a soldier for conspicuous bravery. The order was founded by Napoleon in 1802, and now includes the following ranks: Grand Master (the President of the Republic), Grand Cross (20), Grand Officers (50), Commanders (250), Officers (2,000), and Chevaliers (12,000 maximum). Membership of the order may be conferred upon foreigners and women. The Croix de Guerre established during the World War and the Médaille Militaire, founded by Napoleon III, are France's chief military decorations.

Germany's highest military decoration was the Order for Merit (Ordre pour le Mérite), dating back to 1740. The grades of the Iron Cross, founded in 1813, were bestowed very freely during the World War.

The chief Italian decoration is the Medal of Honour, and in Belgium the Order of Leopold and the Military Cross are the most highly prized. In the United States the most coveted decoration is the Medal of Honour, sometimes called the Congressional Medal, established in 1861, awarded to members of both Army and Navy for acts of extreme heroism in war.

The British orders of knighthood, mentioned below, confer upon the holder a rank of precedence. Those who are "knights" are addressed "Sir," unless they have some higher title. Simple knighthood, that is, the knighting of anyone not belonging to an order, by the King or Queen, still exists in Britain. This method of bestowing knighthood is the oldest of all, and recipients are known as knights bachelor.

Among the most important of the British orders are the following. The Order of the Garter, established by Edward III about 1348. Its motto is *Honi soit qui mal y pense* ("Evil be to him who evil thinks"), membership is indicated by the letters KG. The Order of the Thistle is an ancient Scottish order founded or refounded by James II in 1687, initials KT. The Order of St. Patrick, for Ireland, was created in 1783, initials KP.

The Order of the Bath, which was founded in 1399, consists of three classes—Knights Grand Cross (GCB), Knights Commanders (KCB), and Companions (CB). The Order of St. Michael and St. George was created in 1818, and is similarly divided into three classes (GCMG, KCMG, and CMG). There are two further orders of knighthood.

to be mentioned the Royal Victorian Order (G C V O, K C V O, C V O, and M V O), founded in 1896 (the statutes of which were amended in May, 1936, by King Edward VIII so that women might receive the order, Queen Mary becoming the first Dame Grand Cross), and the Order of the British Empire (G B E, K B E, D B E, C B E, O B E, and M B E), founded in 1917. The letters D B E are used by women who have received this order. Recipients may use the word Dame before the name, e.g., Dame Margaret Lloyd George.

As Emperor of India the King is the head of two other orders of knighthood: the Order of the Star of India (G C S I, K C S I, and C S I), founded in 1861, and the Order of the Indian Empire (G C I E, K C I E, and C I E) founded in 1877.

A very coveted distinction, although it is not an order of knighthood and therefore does not give the right to use any title, is the Order of Merit (O M), founded by King Edward VII in 1902. The number of living members is limited to 24, and it is bestowed only on (1) military men, and (2) statesmen, men of letters, artists, scientists, and others who have rendered eminent service to the state. An order of the same kind, but of not quite the same distinction, is that of the Companions of Honour (C H). Both these orders are open to men and women alike.

Oregon, U S A Oregon is a State of the U S A abounding in sharp contrasts in green forests and snow clad peaks, in fertile valleys and bleak deserts, in populous settlements and uninhabited plains. It covers an area of 96 700 square miles between Washington and California on the western coast. Forty miles inland is the low Coastal Range, and sixty miles beyond this stretches the towering Cascade Range, with snow-capped Mount Hood (11 253 ft) at its northern end. To the west of this range the climate is similar to that of Great Britain, but to the east are the Great Sandy Desert and vast tracts of uninhabited forests. So it is not surprising that the population is only 953 800.

Salem, a city of 26 300 people is the capital, but Portland is the chief commercial centre. It is a port, 110 miles from the sea, with 301 800 inhabitants. Three of the chief industries are timber, fruit farming, and the salmon fisheries of the Columbia river. Three large tracts of country are specially reserved for Indians, and a National Park in the Cascade Range preserves the famed beauty of the superb Crater Lake.

Organ. When you look at the keys of a pipe organ you see only a very small part of the organ itself, for it is the largest of all musical instruments. Sometimes above the keys of some organs you see rows of pipes that make the tones, but more often the organ is built as a part of the building, like a separate room,

and the pipes along with the rest of the machinery, are hidden behind the walls.

In an organ there are hundreds, sometimes thousands of pipes. Some are as large as the trunks of full grown trees, these make the deep heavy notes. Some are smaller than a lead pencil, these make the higher notes. The pipes are arranged in groups. Each group is controlled by a stop which is placed in reach of the organist. As he wishes to use any particular group, he opens the proper stop and thus connects it with the keyboard. The air which causes the pipes to sound is forced into them from an air chamber into which it has been pumped by a bellows or electric fan.

Organs with Five Keyboards

Some organs have as many as five rows or banks of keys. Each row is called a manual because it is played by the hands (from the Latin word *manus*, hand) and each manual is connected with a particular set of pipes. When a key is pressed down, a valve is moved which admits air to a certain pipe. The most important manual is called the great organ, the other keyboards control the choir, swell, and solo organs. If the organ has a fifth manual, it is for the echo organ or a sixth manual for powerful trumpet stops. In the largest instruments, which have seven or eight organs, one or more of the manuals may control two organs. In addition to manipulating the stops and the different manuals, the organist seated at his 'console' plays with his feet another keyboard called the pedal organ. These keys are made of wood and are very large.

The organs of early days were very different from the organs of today. The first instrument of this type was the pan's pipes of the ancient Greeks, which consisted of a set of pipes sounded by the player's breath. About two centuries ago a device was invented for forcing air into the pipes by water power, and keys were added to open and close the pipes.

Introduction of Bellows

Centuries later the bellows came into use, instead of water power, to furnish air. An organ built in the 16th century for Winchester Cathedral had a bellows so powerful that 70 men were needed to pump it. In the great organs of today the power that pumps the bellows may be 25 or even 40 horse power, yet so improved is the mechanism of the keyboard that the touch of a finger is all that is required to open the pipe valve.

The greatest changes are due to the use of electricity. So much of the machinery is now operated by this power that the inside of the organ looks like a telephone exchange. By means of electricity one person can now control the 18,000 pipes found in some of the largest organs, and by electrical devices organs are

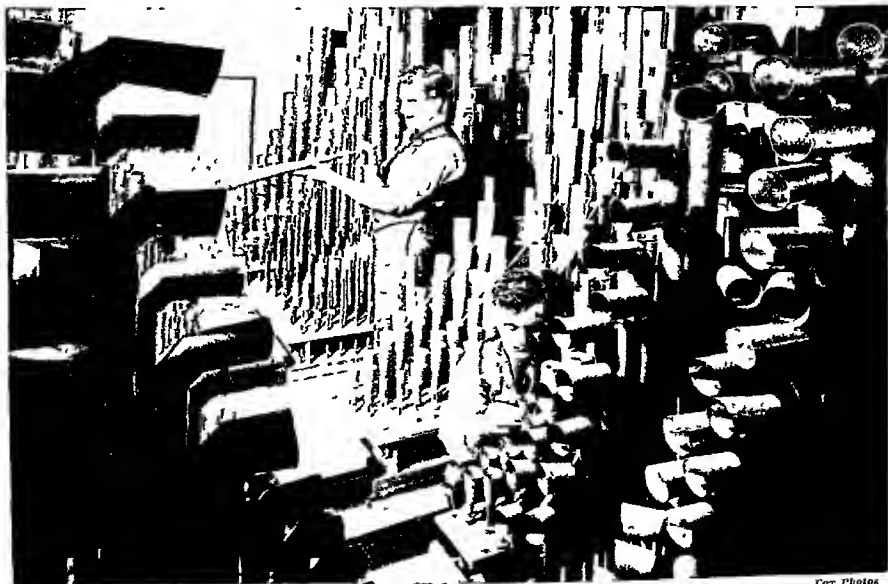
now fitted with attachments of bells, drums, harps, and even coloured lights. A number of the finest organs now being built are for the cinemas, capable of all kinds of "effects."

Much like the pipe organ is the harmonium, sometimes called the reed or cabinet organ, often found in rural schools and churches. Instead of pipes it has a great number of freely vibrating "reeds," or thin strips of wood or metal of varying length and thickness, which produce the various tones. Air is provided by a bellows worked by the feet. Famous organs in England include the concert organ in the Royal Albert Hall (reconstructed in 1934 at a cost of £26,000), the B B C concert and theatre organs, the new instrument installed in Westminster Abbey for the Coronation in 1937, and the great organ to be used in the new Liverpool Cathedral.

Orino'co, River "I know all the earth doth not yield the like confluence of streams and branches, the one crossing the other as many times, and all as fair and large and so like one to another as no man can tell which

to take." Thus Sir Walter Raleigh described the huge delta of the Orinoco, which he visited on his search for El Dorado in 1595. His description is not at all exaggerated, for this fan-shaped delta, nearly as large as the island of Sicily, is traversed by more than 50 channels, and escape from it would be almost impossible to any but an experienced pilot. Indians conceal themselves in the fringes of trackless forests, where the charm of foliage and flower is enhanced by the presence of countless birds of richest plumage and dazzling hue. Monkeys disport themselves among the branches, which are hung with rare orchids and other au-plants of countless variety, and "bush ropes" or *begucos*, cross one another from tree to tree, forming a trellis-work that is almost impassable. The soil is even more fertile than that of the Nile valley, and produces fine tropical fruits.

Above the delta, 120 miles from the sea, even in the dry season the river is no less than 12 miles in width. Ciudad Bolivar, 260 miles from the sea, is the metropolis of the Orinoco basin and the centre of the river trade. The land

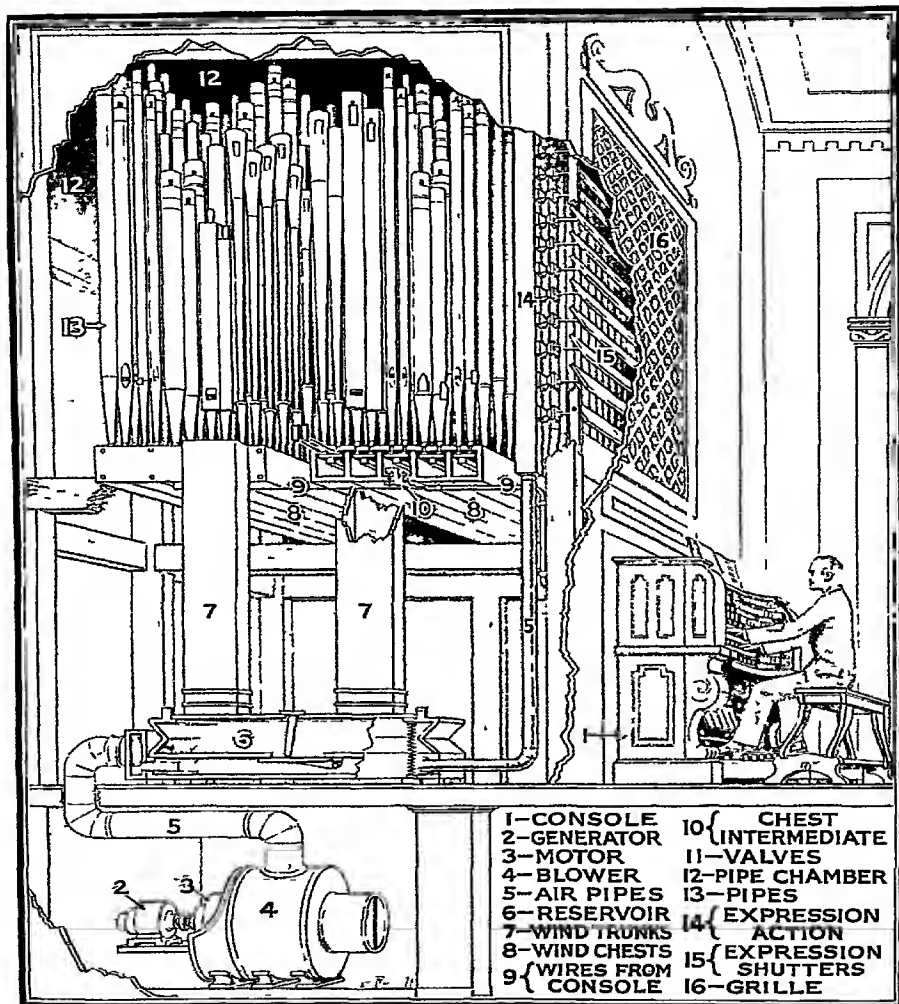


Fox Photos

AMONG THE PIPES OF A GREAT LONDON ORGAN

The organ at the Royal Albert Hall, London, is said to be one of the largest and finest in the world. It weighs 175 tons, and has no fewer than 10,491 pipes. In the 1930's this organ was changed from mechanical to electro-pneumatic action, and the reconstruction, which took six years to complete, cost £26,000. The photograph shows the solo and bombarde complement to the great organ. The solo is sometimes called the orchestral organ because many of the stops resemble orchestral instruments. The bombarde, or echo organ, supplies the deep-toned fortissimo passages.

HOW A MIGHTY ORGAN 'BREATHES' AND 'SINGS'



When the organist touches the keys of his console (1) an electric contact at the back of each key presses another contact sending an electric current along a wire (9) to an electromagnet called the chest intermediate (10). Magnetized by the current, the chest intermediate lifts a metal disk releasing some of the air pressure which holds a little valve (11) against the base of each pipe. As the valve drops, air from the wind chest (8) rushes up through the pipe, making it speak. A blower (4) driven by a motor (3), with a generator (2) if direct current is not available, forces compressed air through the air pipes (5), reservoir (6), and wind trunks (7) to the wind chests. Pedals on the console control a series of bellows called the expression action (14). They open or close shutters (15) outside the pipe chamber (12), to increase or reduce the sound. An ornamental grille (16) masks the pipe, and organ mechanism.

LIFE ON THE BANKS OF THE MIGHTY ORINOCO



Photos E. N. A.

The upper photograph was taken at Ciudad Bolívar, Venezuela, where the Orinoco sweeps past this point of rock with such force as to scour out a channel to a depth of 262 feet below sea level. The white patches on the rocks are washings from the local public laundry being bleached under the tropical sun. The lower photograph shows another aspect of the Orinoco, at a point not far distant from the city of Ciudad Bolívar, and here the enormous width of the river is fully apparent.

above the delta is mostly a vast, treeless, grassy plain—the *llanos*—where millions of cattle, sheep, and horses feed. The source of the Orinoco was veiled in mystery until Dr Herbert S. Dickey discovered it in 1931.

The Orinoco is one of the largest rivers in South America. It rises in the Sierra Parima range on the Brazil-Venezuela boundary and flows through central Venezuela to the Atlantic. It is about 1,600 miles long, and is navigable for large steamers for 700 miles.

Oriole. Some members of this family of birds come to life in a cup shaped nest hanging in a fork on the tip of a branch of a high tree, but they are quite safe, for their little hammock is very strongly woven of shreds of bark and most skilfully slung.

The orioles are found in the temperate and tropical parts of the Old World. They are usually brilliantly coloured. Their food consists chiefly of insects and fruit, and they prefer big trees to little ones.

The golden oriole (*Oriolus galbula*) often visits Great Britain, but very rarely nests here. It is not uncommon on the Continent, where each pair pegs out its own particular claim in the forest. It is about the size of a blackbird and is very beautiful. The male is rich golden-yellow and black, the hen bird also possesses some green markings.

The birds called orioles in the USA belong to a different family, the *Icteridae*.

Orion. (Pron or i'-on) A mighty hunter famed in Greek legend Orion was noted for his beauty and gigantic size and strength. According to the best known story about him, Orion was loved by the goddess Artemis (Diana), whose hunter he became. Her brother Apollo was angered at this, and one day, seeing Orion swimming, he pointed out to Artemis a black object in the water and challenged her to hit it with her arrow. She shot at it, finding when too late that it was the head of her lover. After his death he was placed among the stars where he appears with a lion's skin, girdle, sword, and club, followed by his hound. The constellation of Orion is one of the brightest in the northern heavens. The three bright stars across its centre are called "Orion's belt."



FINE PAIR OF ORIOLES

The golden oriole, a relative of our blackbirds and thrushes, is a glorious bird, for the cock (upper bird) is a brilliant yellow, with black on the wings and tail. It is rare in Britain, being usually shot by collectors whenever it puts in an appearance.

Photo: British Museum Natural History

Orissa, INDIA. The province of Orissa situated between Bengal and Madras, came into being in 1936. Formerly it was the southern half of the province known as Bihar and Orissa. It now consists of six districts, four of which are on the coast of the Bay of Bengal. The total area is 32,700 square miles, with a population of approximately 8,043,600. All Orissa is regarded as holy ground, every town has innumerable temples and each village its own shrine. The famous temple of Jagannath (Juggernaut) is at Puri, a coastal town with 37,000 inhabitants. Cuttack, an ancient city on the delta of the Mahanadi, is the capital and has a population of 65,000. The cultivation of rice is the main occupation of most of the people.

Orkney Islands, SCOTLAND. Like a fleet of ships sailing from Scotland up into the Arctic Ocean lie the 70 islands of the Orkney, windy and treeless, but noted for their hold and rocky scenery. For centuries these islands were the stage for many stirring events and fierce battles, for they were a natural stopping-place for the Vikings in their voyages to the south-west.

Their long black ships with monster figure-heads visited these islands, carrying the bold warriors in their search for plunder and fame to these remote Scottish shores. The islands remained in the hands of the Northmen until 1468, when a needy king of Denmark pledged the Orkneys and Shetlands to James III of Scotland in security for his daughter's dowry. In default of payment they became Scottish territory, Denmark formally consenting to the transfer in 1590.

About thirty of the islands are inhabited. On the largest island, Pomona or Mainland, is Kirkwall, a town of about 4,000 inhabitants, and fourteen miles west of it is Stromness, the next largest town and a favourite summer resort. Other islands worthy of mention are Westray, Sanday, Stronsay, and Hov, the last being particularly mountainous and noted for its beautiful scenery. The inhabitants are largely descendants of the Northmen. On their small farms they raise oats, turnips, barley, and potatoes, and tend their cattle, sheep, and

ORKNEYS

poultry Fishing is also a leading industry The summers, with their long stretches of sun shine, are very attractive, and every year sees a steady increase in the tourist trade There is now a regular passenger and mail air service from the mainland



In the War of 1914-18, and again in 1939 these islands again played their part Scapa Flow, the capacious harbour whose waters are shut in by three of the islands, was a safe anchorage for the British fleet in its ceaseless watch over the North Sea, and here it was that the German fleet was interned after its surrender in 1918 In 1914 Kirkwall, which lies at its northern angle, was the western base from which the stupendous task of laying the North Sea mine barrage was accomplished, and also the point from which, after the Armistice, the no less important and hazardous task of sweeping up the mines was carried on Area of the islands (which are divided from the mainland by the Pentland Firth), 375 square miles, population, about 22 000

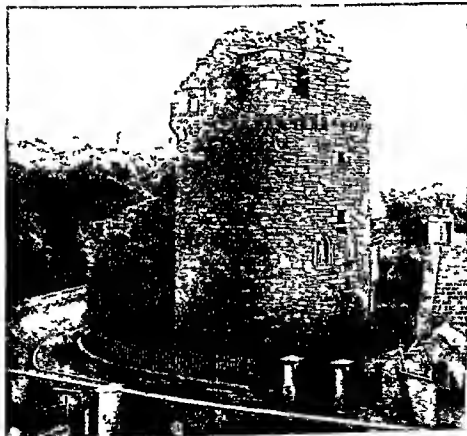
Orleans, FRANCE Many historic memories cling to this old French town, situated at the northernmost bend of the river Loire, about 200 miles from its mouth and 75 miles south-west of Paris It was the site of a Celtic town when the Gauls in 52 B.C. rose against Julius Caesar, and the Roman city that sprang up here was named *Civitas Aurelian* (in honour of the Emperor Aurelian), of which "Orleans" is a corruption

ORLEANS

It was an important place under the Franks and their successors, and its university (founded in 1309) was a celebrated centre for the study of Roman law and the learning of the Renaissance Later it played a part in the Huguenot wars and in the Franco-Prussian War of 1870-71

But most of all it is known as the city besieged by the English in 1429, and relieved by Joan of Arc (*qv*), the heroic "Maid of Orleans" To this day Orleans celebrates each year the anniversary of this deliverance

Modern Orleans is a well-constructed city with broad boulevards, pleasant squares, and bustling river quays Its manufactures include tobacco, blankets and hosiery, harpins, agricultural implements, tools, machinery, etc The city is important as a railway centre and distributing point, its chief interest is in



CLIFF AND CITADEL OF THE ORKNEYS

The upper photograph shows a "stack," or rock pillar separated by the sea from the mainland, these are typical of the Orkney coast, where the wild Atlantic gales pound irresistibly on the shore The lower photograph shows a part of the Bishop's palace at Kirkwall—the Mass Tower, built in 1540

photos top R. N. Hardie bottom Valentine

ORPHEUS

its historical memorials and public buildings These include a cathedral which dates from 1601, an important museum, much curious old timber architecture, and the house in which Joan was lodged after she had raised the siege The population is about 73,000

Orpheus. (Pron or'-fūs) "The father of song," as he was called, was a legendary poet and musician of Greece Presented with a lyre by the god Apollo and instructed by the Muses, Orpheus by his divine music not only enchanted men and beasts, but moved trees and rocks On his travels with the Argonauts in search of the Golden Fleece his music put monsters to sleep and arrested falling cliffs

When his wife Eurydice (pron ūr-id'-is ē) died, Orpheus followed her to Hades, and his music prevailed with iron-hearted Pluto, who allowed her to follow him back to earth, provided he did not look round while they ascended But Orpheus, in his anxiety, forgot this condition, looked back at Eurydice, and lost her for ever

His grief over the loss of Eurydice led him to treat with contempt the women of Thrace, where he dwelt, and in revenge, according to one story, they tore him to pieces The Muses gathered up the fragments of his body and buried them at the foot of Mount Olympus, while in his memory they set his lyre among the stars

Osaka. (Pron ō' sah-kah), JAPAN A few years ago Osaka was merely a picturesque old Japanese city, known as the "Venice of the East" Today the enterprise of its merchants has turned it into the "Birmingham of Japan"

Spread out on both banks of the river Yodo and along Osaka Bay, the city is cut by hundreds of canals, rivulets, and arms of the sea, spanned by more than 500 large bridges Thousands of small boats carry on a brisk internal traffic Costly harbour improvements now enable Osaka to receive large ships and handle much of the foreign trade with Formosa, Korea, and China that formerly went to the port of Kobe, 20 miles distant The bulk of this trade is in rice and tea

OSIRIS

Ancient Shinto and Buddhist temples are numerous, but the people take greater pride in their modern institutions, such as the great mint, the many parks and public playgrounds, big iron works, shipyards, cotton mills, and sugar refineries At one time Osaka was the capital of the country The population today exceeds 3,000,000

Osiris. (Pron ō str'-is) The most popular of the gods in Egyptian mythology was Osiris, the son of Seb (the earth) and Nut (the sky) According to tradition, he was a wise and just king, who conquered all Egypt, introduced



ORPHEUS AND EURYDICE

W. J. Mander

This famous picture by George Frederic Watts depicting a scene from the ancient Greek myth of Orpheus and Eurydice, now hangs in the Tate Gallery in London—where many more of this artist's canvases are to be seen

OSIRIS

culture to the ignorant and barbarous people, and established good laws and institutions. He was slain by his wicked brother Set, who induced him to enter a cunningly devised coffin and then cast the box into the Nile. Isis, the wife of Osiris, after a long search, discovered the body. But Set got it again and cut it into pieces, which he scattered far and wide. These the faithful and sorrowing Isis gathered and buried with due honour.

According to another version of the story, Isis joined the parts of the body together by her magic power, and Osiris became ruler of the dead in the lower world. His son Horus, when he grew up, avenged his father's murder by conquering Set. On earth Osiris became incarnate in the sacred bull Apis. From the combination of the two came the name Osiris-Apis, and from this Serapis, later regarded as a separate deity.

Osiris is usually represented in human form, though sometimes with the head of an ox, ibis, or other animal. He is generally depicted wrapped in mummy clothes, and wears a high crown, with a feather on each side. (See Isis)

Oslo, NORWAY On January 1, 1925, the name of the capital of



OSIRIS

Although he had many aspects, Osiris (above) is best known as Egyptian god of the future life and king of the other world.
Faira Museum

OSLO

Norway was changed by Act of Parliament from Christiania to Oslo. Patriotic reasons inspired the change. Oslo was the name of the ancient city founded by King Harold Sigurdsson in 1048. Later, while Norway was under Danish dominion, the city was burned and the Danish king, Christian IV, rebuilt it on the west bank of the little river Aker and renamed it after himself. What was left of Oslo on the east bank became merely a suburb. Oslo was the port at which the main body of troops landed in the German invasion on April 9, 1940.

As we approach the city by Oslo Fjord, between two inlets, on a high promontory dividing the busy harbour is the old fortress of Akershus (built about 1300), now occupied as an arsenal and prison. On a hill to the north-west, overlooking the city and its chief street, Karl Johans Gate, you see the royal palace, a severe but dignified building. Farther back and encircling the city are the mountains with their superb views of Oslo and the fjord. Here, at Holmenkollen and elsewhere, are the pleasure grounds of the inhabitants, because of the cool pine forests in the summer, and the opportunities for skiing, etc. in winter.



IN THE BUSIEST PART OF MODERN OSLO

Oslo's growth during the past hundred years has been singularly rapid, and today Norway's capital boasts many handsome streets, lined with modern buildings. This photograph shows Storting Street, in the heart of the city, with the imposing National Theatre in the distance. On the left can be seen an entrance to Oslo's underground railway, which five miles away comes to the surface as a suburban line to Holmenkollen, a winter sports centre.



In the city are the buildings which house the Parliament or Storting the National Theatre, and the University. Near the University are the Museum of Art and a historical museum. At Bygdoy, south-west of the city, are exhibited three very ancient Viking ships.

Oslo has grown considerably in recent decades, and today the visitor finds it a modern city, with handsome public and business buildings, an underground railway, good schools, and many beautiful suburbs. Shipping is the main industry, closely followed by the manufacture of matches, leather, machinery, and paper, the chief exports are lumber and fish. Oslo's population is about 253,000.

Ostrich. This bird, which inhabits the deserts of Africa and Arabia, is one of the world's fastest travellers. When running at full speed an ostrich is able to outrun even the famous Arab horses, exceeding easily a speed of 30 miles an hour.

The absence of proper wings and tail, the elevation of the back, the long, erect, curved neck, and the long, stout legs give the ostrich a most un-birdlike appearance. Its length of legs and neck produce a height of 7 to 8 feet, it weighs from 150 to 300 lb, and is by far the largest bird in existence. In the male the feathers covering the body are a rich black. The feathers of the absurdly small wings and of the tail are pure white, these are most highly prized as plumes. The ostrich has only two toes, its feet being well adapted to running over the sand.

Three or four hen birds share a single nest, which is a large hollow scooped in the sand.



A BIRD THAT CANNOT FLY

Ostrich eggs are laid in a shallow hole in the sand scraped out by the cock bird. The top photograph shows two young ostriches just hatched out. The lower photograph of an ostrich running clearly shows its powerful legs.

OSTRICH

The male bird looks after the eggs at night, when jackals are prowling, the hens taking turns in the daytime, but the sun does most of the incubating. The brood rarely exceeds 20 in number, for many of the eggs are probably broken up to feed the chicks. They are good food, and the shells are very thick and are often used as drinking utensils. A single egg weighs about 3 lb., and takes 40 minutes to boil hard.

The male protects his family faithfully. If molested he fights viciously, kicking sideways or forwards so powerfully that men and horses have been killed by the blow. It is he who yields the most valuable plumage, for the female is much plainer. When he desires to impress the female with his own importance, he has a habit of swelling his neck, meanwhile keeping his beak tightly closed, and then slowly emitting a sound like the lowing of an ox.

The domestication of the ostrich was begun about 1850 by the French in Algiers and the English in Cape Colony. There are, according to the last return, some 30,000 domestic ostriches in the Union of South Africa. They bring in a smaller revenue than formerly, and the export of feathers in 1935 was valued at £28,252. In the United States there are domesticated ostriches in California, Arizona, Texas, and Florida.

OTHELLO

The newly-hatched bird is the size of a small full-grown chicken, and in six months is nearly as big as its parents. But the female does not mature until almost four years old, although the birds yield plumage at the age of six months. Some specimens have been known to live to be 100 years old. The commonest ostrich is *Struthio camelus*, but there are several other species. Like the emu and other flightless birds, the ostrich belongs to the group Ratites of the family *Struthionidae*.

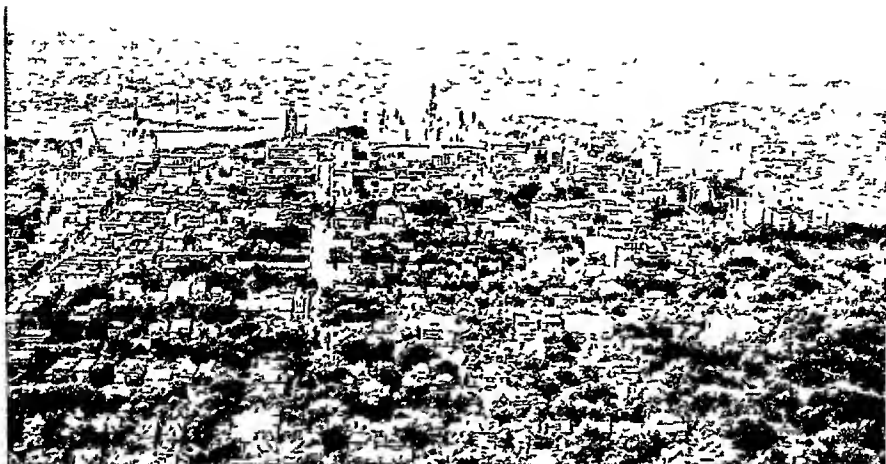
'Othello.' At the heart of this Shakespearean tragedy, coiled like a snake, is Iago, a knave of the most surpassing cunning. Considering himself injured by Othello, the great Moorish captain of Venice, Iago goes craftily to work to wreck that open and free nature's happiness. He perceives that all the joy of Othello's life is centred in the affection of his innocent young bride, Desdemona. It is here, therefore, that Iago strikes.

With diabolic skill "honest Iago" instils into Othello's mind, drop by drop, the poison of jealousy—hinting that Desdemona bestows her love on Othello's handsome lieutenant, and contriving to bring about situations that lend colour to his slander. Maddened at length with suspicion and the anguish of wronged love, the



OTHELLO THRILLS DESDEMONA WITH HIS LIFE-STORY

In the course of the first act of Shakespeare's "Othello," Othello is brought before the Duke and Senators of Venice, accused of having stolen Desdemona's affections by witchcraft. Thus he denies, asserting that he won her love by telling her of his adventurous life, "of moving accident by flood and field, of hair-breadth 'scapes," the imminent deadly breach." This painting, by George E. Robertson, shows Othello relating his adventures to Desdemona and her father.



BIRD'S EYE VIEW OF CANADA'S CAPITAL

Canadian News Bureau

In this striking photograph of Ottawa, the fine Parliament buildings, reconstructed after the disastrous fire of February, 1916 can be clearly seen dominating the river in the centre. Immediately behind is the Royal Alexandra Bridge, which carries the railway over the Ottawa river to the handsome Central Station seen on the right. Ottawa is largely a residential city, with beautiful tree-lined streets. Founded in 1829, as a residence for British engineers, the town was called Bytown until 1854.

Moor strangles his bride. Then, too late, he learns what villainy Iago has practised on him. He is seized with terrible remorse and in agony slays himself, while Iago is led off to a well merited prison and torture.

The play is one of Shakespeare's four supreme masterpieces in tragedy. It is Iago, hinting that Desdemona's good name stands endangered, who says—

Good name, in man or woman, dear my lord
Is the immediate jewel of their souls:
Who steals my purse, steals trash; 'tis something,
nothing;
'Twas mine, 'tis his, and has been slave to thousands;
But he that filches from me my good name
Robs me of that, which not enriches him,
And makes me poor indeed.

Poor Othello in his final speech asks only—

Speak of me as I am—nothing extenuate
Nor set down aught in malice: then must you speak
Of one that loved not wisely but too well,
Of one not easily jealous, but being wrought,
Perplexed in the extreme, of one whose hand
Like the base Indian threw a pearl away
Richer than all his tribe: of one whose subdued eyes,
Albeit usenced to the melting mood,
Drop tears as fast as the Arabian trees
Their medicinal gum.

Ottawa, CANADA A magnificent sweep of river-belted hills, fringed in brilliant green and crowned with lofty and dignified towers—such is one's first impression of the city of Ottawa. The capital of the Dominion of Canada, it is situated on the right bank of the river Ottawa, near the eastern corner of the rich Province of Ontario. It has picturesque tree-lined streets, parks, and several fine bridges thrown over the rushing waters of the river Rideau, which flows into the Ottawa from the south, skirting the city to the south and east. Over all towers the group of impressive Gothic buildings on the summit of Parliament Hill, rising 150 feet sheer above the river level. Here the Canadian Parliament sits, and near by are the executive offices of the Dominion Government, where are administered the affairs of a country nearly as vast as all Europe. Ottawa was a centre of world interest during 1932, when the Imperial Economic Conference was held here.

The river Ottawa, here 600 feet wide after racing over a series of rapids, plunges downward in the Chaudiere Falls, a distance of 40 feet, and a little farther on a curtain of shimmering



OTTER—CHAMPION SWIMMER OF THE LAND ANIMALS

Here the artist has shown an otter with his captured prey, a salmon. It is said that when an otter eats a fish, he holds his prey firmly between his paws, begins at the head, and eats down to the tail, which he leaves. His teeth are strong and very sharp. Because of the fishy taste of his flesh and his aquatic habits, the otter in medieval times was considered a fish. A full-grown otter weighs about 25 pounds.

must masks the spot where the Rideau pours over high rocks into the larger stream. Opposite and a little below the Rideau Falls, the Gatineau flows into the Ottawa from the Province of Quebec to the north.

Within a radius of ten miles Ottawa has available a rush of waters capable of producing more than 1,000,000 horse-power. Much of this is already harnessed to the city's thriving industries. Below the city the Ottawa becomes navigable, forming a highway through the St. Lawrence to the sea. The Rideau Canal running southward connects Ottawa with the Great Lakes at Kingston, and the valleys of the upper Ottawa and the Gatineau lead to the city the products of the rich regions stretching away to the west and north.

The timber industry surpasses all others. Millions of feet of logs are floated down the Ottawa and Gatineau rivers every year. Meat packing, leather goods, brick and tile works, machine shops, railway carriage and repair shops, foundries, clothing factories, and cement works add to the list of thriving industries. The Canadian Pacific, the Canadian National, and the New York Central railway lines meet here.

Besides the group of government buildings, which includes the excellent Parliamentary Library, Ottawa has two cathedrals—one Church of England and the other Roman Catholic—the University of Ottawa (Roman Catholic), and several colleges and technical schools.

Philemon Wright, a New Englander who settled on the north side of the river in 1800, may be regarded as the founder of Ottawa. In 1826 Colonel John By was sent from England to construct the Rideau Canal, and his engineers and workmen established the settlement of Bytown, which formed the nucleus of the present city. In 1854 the town was incorporated and its name changed to Ottawa. Four years later Queen Victoria selected Ottawa for the Canadian capital, and it remained the capital after the formation of the Dominion in 1867. The population is about 124,000, exclusive of suburbs.

Otter. If the land animals should hold a swimming and diving contest the otter would assuredly be a candidate for championship honours. He is really as much at home in the water as on land, diving, rising, and turning with lightning quickness, and yet he can move fast enough on land to outpace many dogs.

The English otter, *Lutra vulgaris*, is related to the weasel, but is much larger. Its body is about 3½ feet long, including the tail, which measures 15 or 16 inches, and it has short limbs and webbed feet. It is seal-like in form and is covered with a thick coat of fine dark-brown fur. Its nest is usually in a hollow in a river bank.

The common otter is widely distributed over Europe and Asia, and allied species are found in North, South and Central America, Africa, and parts of Asia. In certain parts of India and China tame otters are used to catch fish.

In Great Britain and Ireland the otter is becoming scarce, for it is so destructive to fish which forms its principal food, that where the rivers are preserved for fishing otters are killed. Otter hunting (see Hunting) also accounts for a good many of these creatures.

The sea otter (*Lutra lutris*) is much larger and heavier. It is one of the most valuable of all fur bearing animals, and a single skin will fetch several hundred pounds. It was once abundant in the Pacific from California northward, but now is very rare, except about the Aleutian Islands, where it is protected by law. It is about four feet long.

Otto. EMPERORS OF THE HOLY ROMAN EMPIRE. Four emperors of the Holy Roman Empire bear the name Otto (Otho). OTTO I (912-973) of the Saxon line ruled Germany from 936 to 973, and in 962 re-established the empire of Charlemagne under the name of "the Holy Roman Empire of the German Nation." This emperor is usually known as 'the Great.' He is described as having eyes that moved incessantly "as if they were watching their prey." His deeds show him to have been a man of energy, courage, and military skill. He strengthened the royal control over the unruly German dukes, conquered Italy in 952, and

three years later won a great victory over the invading Hungarians (Magyars) at the battle of Lechfeld in Bavaria.

His son, OTTO II (955-983), was emperor from 973 to 983. He largely maintained the gains of Otto I. He died in Rome, at the age of 28, while on an expedition to that rebellious country. He is buried in St. Peter's.

His son, OTTO III (980-1002), became German king when he was three years old, and was crowned emperor in 996 by the Pope at Rome when he was sixteen. His mother was a Byzantine princess, and his tutor Gerbert (later Pope Sylvester II) was one of the most learned men of that day, especially in mathematics. The young emperor himself, however, was dreamy and unpractical. With his death in 1002 the direct Saxon line of emperors came to an end.

OTTO IV (c. 1182-1218) was of the house of Welf (Guelf), was educated at the court of Richard I of England, and was put forth as a rival candidate against the Hohenstaufen Philip of Swabia. Although he gained the imperial throne in 1208, the emperor was so hostile to the Church that the Pope excommunicated him in favour of Frederick II. Beaten (1214) at the battle of Bouvines, in northern France, with his ally, King John of England, Otto died May 19, 1218.

The TRUTH about the WISE OLD OWL

*Its solemn face is alone responsible for the owl's reputation for wisdom,
for in its actions it shows no more intelligence than other birds.
But, if not particularly wise, it is useful, as we learn here*

Owl. How wise is an owl? Probably not so wise as he is useful, for the victims of these 200 or so species of birds of prey are generally small rodents, harmful to the farmer's crops.



The Tawny Owl
Photo J. T. Roberts

Owls swallow their food whole, and later eject from their mouths, in the form of pellets, the bones, hair, and all indigestible parts, and an expert can tell, from the pellets found near an owl's roosting place, just what sort of owl is nesting there.

Most owls do all their hunting at night, and the daylight is too strong for their eyes. In daylight they sit and blink, and their reputation for wisdom, as in the case of some humans, is probably due to their solemn silence as well as to their wise look. They are distinguished from all other birds by the peculiar radiating systems of feathers

surrounding their eyes. These circles are bounded by a rim of stiff recurved feathers that give the effect of a mask worn over the face. The neck is short and thick, and the legs are set so far back on the body that the bird sits in an upright position. The plumage which is generally grey or brown mottled with lighter shades, is very fluffy and gives the owl an appearance of great size, the feathers of the wings especially are very soft, and to this the owl owes the complete silence of its movements when it is on the wing.

Owls usually nest in old buildings, in cavities of rocks and trees, or on the bare ground. Sometimes the birds repair the discarded nests of hawks or squirrels, or use the burrows of rabbits or other animals. The eggs, invariably white, are from three to five in number, and, instead of being laid on successive days and then incubated, are laid at much longer intervals. It is usual, therefore, to find a nest full of owlets all of different ages.

Owls are found in all parts of the world. Barn owls (*Strix flammea*) are fairly generally distributed in Great Britain, and as their note is a kind of scream, they also go by the name



The little owl (*Athene noctua*), which is the one associated in classical literature with Pallas, the goddess of wisdom, was introduced into Britain many years ago and is now often regarded as a pest, being accused of killing chicks of poultry and game-birds. Our smallest owl, it is the one most seen in broad daylight.

The beautiful snowy owl, with its white plumage, breeds in cold regions, Northern Siberia and Lapland and the northern regions of North America being its favourite haunts. It is occasionally seen in England.

The owl whose adventures are told in the following pages is the American screech-owl.

OWLS OF THE MOOR AND THE SNOW

The short-eared owl (above) is a curiously round-faced bird. It is an inhabitant of the moorland regions, and its speckled plumage serves to camouflage it in such a background. Similarly, the handsome snowy owl (lower picture) is white, a colour which makes it almost invisible in the ice and snow of the Arctic.

Photos top Fischer bottom Ray Palmer

of screech-owl. Most barn owls have a heart-shaped face-mask with an inner circle of feathers about their eyes.

The tawny owl, or wood owl (*Syrnium aluco*), is found in almost every part of the world. It is common in England, nearly every wood having a pair. Its note is the well-known hooting cry "tu-whit, tu-whoo." It generally nests in hollow trees, but occasionally in ruins. Like other owls, if it starts from its home in the daytime it is usually set upon and mobbed by numbers of finches, tits, and other small birds.

Like the wood owl, the long-eared owl (*Asio otus*) is a forest-dweller. In England a pair of these birds usually keep to one particular wood. Unlike most owls, its voice is seldom heard.

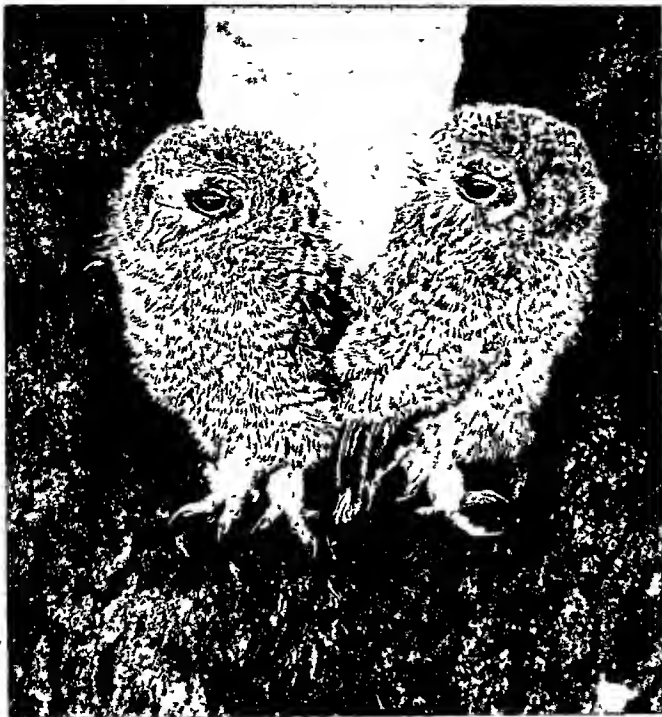
The short-eared owl (*Asio accipitrinus*) has a world-wide range and is common in Britain. The ear tufts are very short, and the face is strangely round and always looks surprised. It is not found in woods, but in open fields and moors, where it feeds on field voles.



TAWNY OWL, NIGHT-WATCHMAN OF THE WOODS



This is our commonest owl, found in all districts where there are plenty of trees, and known also as the wood owl and brown owl. Most specimens have rather less white about them than the one here depicted but the general build of the bird whatever its colour is typical of its group. Notice the way in which there is a real face with feathers radiating out all round the eyes, and that the feet are covered with soft feathers.



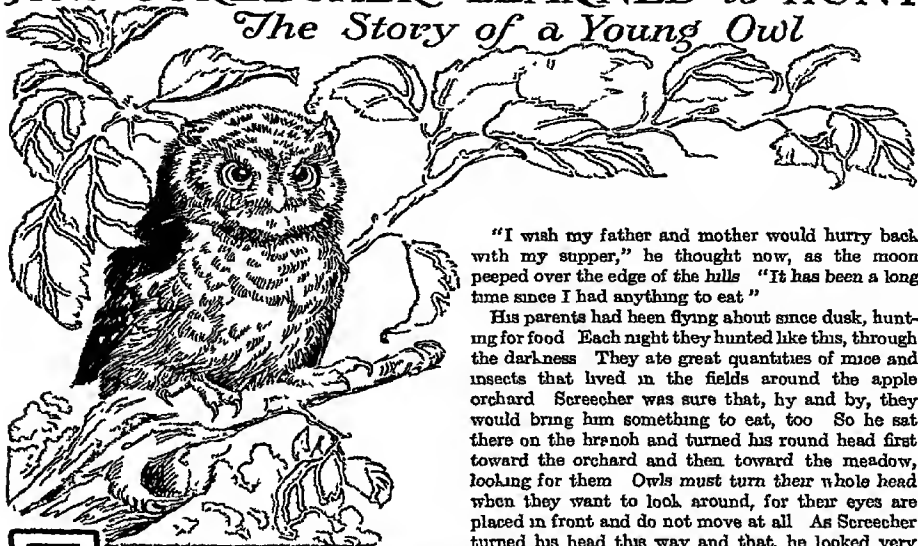
FLUFFY PAIR OF TAWNY OWLETS

THESE two little owlets have evidently just come out from their nest, situated in a hole in the old tree in whose crutch they are standing. They have not yet lost the coat of down which has covered them since birth, although the right hand one has begun to get proper feathers on its wings. Brought at this stage, or a little younger, they make excellent pets, although a good deal of time and trouble is often needed to feed them, since their appetites are tremendous. Moreover, if two are kept together in the same cage, they are liable to turn cannibal and try to eat each other! These youngsters will grow up into big tawny owls like the one shown in the colour plate overleaf. This bird nests in trees, in buildings or on the ground, it is most useful to the farmer, killing many small rodents and insects.

Photo Stanley Crook

How SCREECHER LEARNED to HUNT

The Story of a Young Owl



THE OLD apple orchard was very peaceful and quiet in the twilight. Most of the birds had gone to rest, and only an occasional sleepy note broke the evening stillness. On a branch of an apple tree at the edge of the orchard, Screecher, a downy young owl, sat blinking his great eyes. He was waiting for his parents to return with food for him.

Most of the day Screecher had been asleep in the family nest—a bare hole inside the apple tree. Like most owls, he slept in the daytime. Now that the sun had gone down, he was wide awake and very hungry for his supper.

He was lonely, too, because the three other little owls who had been hatched there in the family nest had already flown away. They had wanted Screecher to fly away with them, but he was not yet ready to go. It was pleasant to stay here in the old apple tree, sleeping through the day, and waking at evening to eat the beetles and bugs, or perhaps the fine fat field mouse, that his parents brought him. And it was pleasant to sit here in the darkness and listen to the cries of other owls, as they flew softly about in search of food. So, although the other little owls had made fun of him, young Screecher had stayed on in the old apple tree.

"I wish my father and mother would hurry back with my supper," he thought now, as the moon peeped over the edge of the hills. "It has been a long time since I had anything to eat."

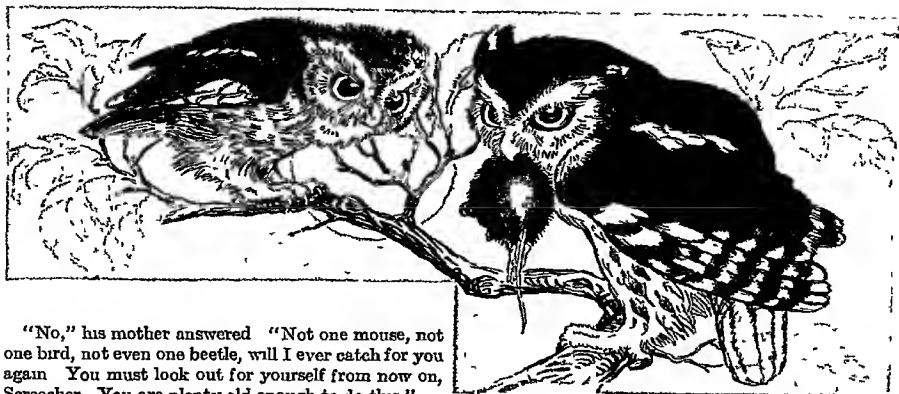
His parents had been flying about since dusk, hunting for food. Each night they hunted like this, through the darkness. They ate great quantities of mice and insects that lived in the fields around the apple orchard. Screecher was sure that, by and by, they would bring him something to eat, too. So he sat there on the branch and turned his round head first toward the orchard and then toward the meadow, looking for them. Owls must turn their whole head when they want to look around, for their eyes are placed in front and do not move at all. As Screecher turned his head this way and that, he looked very grave and solemn, and a little angry, too, for he was getting hungrier and hungrier.

Presently he saw his mother flying toward him, her wings moving slowly and silently. For a moment he watched her in admiration. He loved to watch his parents fly. The soft feathers on their wings were tipped with a downy fringe, so that they could move through the air without making any sound at all. And because they flew so silently, they could hear the little creatures moving about through the grass, and could pounce upon them so noiselessly that it made young Screecher very proud of them. He, too, would fly like this some day, he knew, and he hoped he would have fine reddish brown feathers, like his father's. Many screech owls are grey, and Screecher thought his father was much more splendid than the grey owls.

"What did you bring me for supper?" he asked eagerly, when his mother alighted on the branch beside him.

"Nothing," she told him. "Your father and I think it is high time you were learning to catch your own food."

"But I am so hungry, mother," Screecher complained in surprise. "Won't you please catch me something to eat?"



The father owl had pounced upon a field mouse

"No," his mother answered "Not one mouse, not one bird, not even one beetle, will I ever catch for you again You must look out for yourself from now on, Screecher You are plenty old enough to do this "

"Oh, dear!" Screecher cried, in his high quavering voice "Oh, dear! What shall I do?"

Just then his father alighted on the apple tree, and the young owl stopped his crying at once "Father," he begged, "you will catch a mouse for me, won't you? You won't let me go hungry, I know "

"There is no need for you to go hungry, Screecher," the father owl said pleasantly "There is plenty of food to be found on the ground You have only to fly a little way to get all you want "

"Oh, father!" Again Screecher raised his voice "I don't want to get my own supper! I want you to bring it to me Pl—e—ase!"

The father owl did not wait for Screecher to say anything more, but flew softly to the ground "Now," thought the young owl, "he will bring me my supper I knew he would if I coaxed "

The father owl had pounced upon a field mouse and, holding it in his claws, he flew back to the branch beside Screecher But to the young owl's dismay, his father at once began to eat the mouse

"Oh, father!" Screecher cried sharply, "you are eating my mouse!"

"No," his father replied, "this is my mouse I caught it, you know If you want food, you must catch it for yourself now You have good sharp ears, and if you will only listen, you will hear any number of small creatures moving about on the ground They will make a fine meal for you "

Screecher was disappointed, but he obeyed his father and, sure enough, he heard something stirring in the grass Without waiting a moment, he flew down and caught a fine fat beetle!

"There! That's right," said his father, when Screecher was once more beside him on the branch

"A little later, you can practise catching mice You will soon be able to do it as well as I do "

With this, the father owl gave his long quavering cry and flew away The mother owl, with only a glance to see that Screecher was all right, flew after him

"Well," thought Screecher, as he watched them go, "it is plain to be seen that if I want any more supper, I must catch it for myself " And then hearing another heetle he flew down and seized it

All night long he flew about, finding all kinds of dainties in the grass—earthworms, moths, spiders, and even an occasional snail He ate so many of them that at last he could not eat another thing

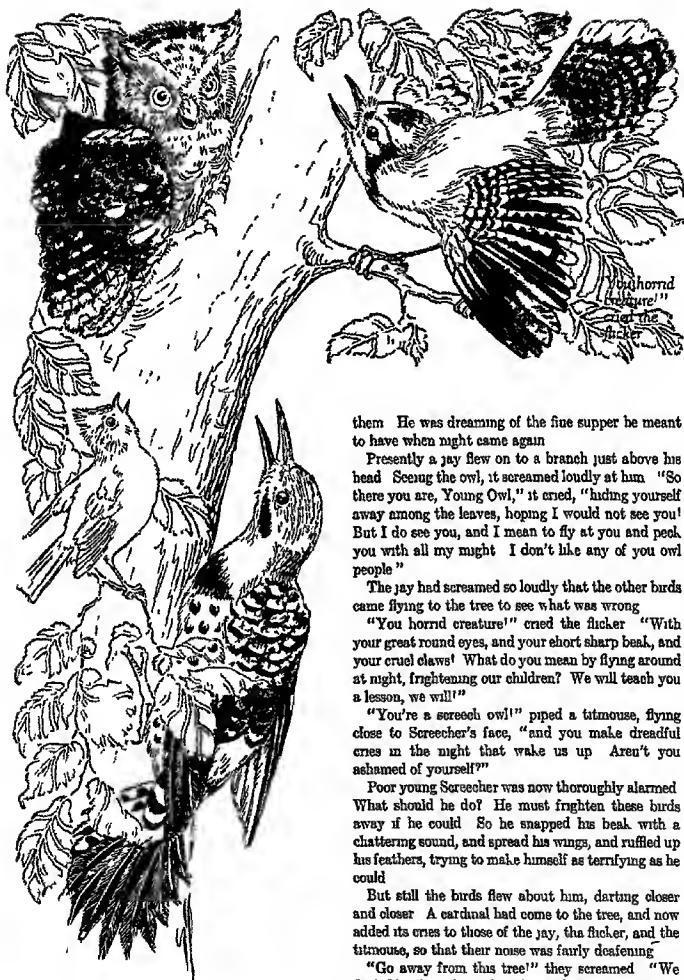
The east was now growing pale with the coming dawn The young owl decided to go back to his nest and sleep until another night should come But, as he looked about, he found that his own apple tree was nowhere to be seen He had flown so far from home in his search for food that he could not find his way back! He was lost!

At first this frightened him, for the day was coming fast, and he did not see very well in the daylight But after a moment, he wisely decided to seek shelter in the thick branches of a near-by tree "I will wait here until darkness comes again," he thought, "and then I can find my way home "

When he was settled on a leafy branch, he turned his round head from side to side to look about and be sure that he was well hidden Then he contentedly shut his eyes and went to sleep

Higher and higher rose the sun The birds sang gaily all around him, but Screecher did not hear

OWL



them. He was dreaming of the fine supper he meant to have when night came again.

Presently a jay flew on to a branch just above his head. Seeing the owl, it screamed loudly at him. "So there you are, Young Owl," it cried, "hiding yourself away among the leaves, hoping I would not see you! But I do see you, and I mean to fly at you and peck you with all my might. I don't like any of you owl people."

The jay had screamed so loudly that the other birds came flying to the tree to see what was wrong.

"You horrid creature!" cried the flicker. "With your great round eyes, and your short sharp beak, and your cruel claws! What do you mean by flying around at night, frightening our children? We will teach you a lesson, we will!"

"You're a screech owl!" piped a titmouse, flying close to Screecher's face, "and you make dreadful cries in the night that wake us up. Aren't you ashamed of yourself?"

Poor young Screecher was now thoroughly alarmed. What should he do? He must frighten these birds away if he could. So he snapped his beak with a chattering sound, and spread his wings, and ruffled up his feathers, trying to make himself as terrifying as he could.

But still the birds flew about him, darting closer and closer. A cardinal had come to the tree, and now added its cries to those of the jay, the flicker, and the titmouse, so that their noise was fairly deafening.

"Go away from this tree!" they screamed. "We don't like those funny bunches of feathers that stand

up on your head like horns Why should you have horns, anyhow? We don't!"

"They are not horns!" Screecher answered angrily "They are tufts of feathers that grow above my ears And good sharp ears I have, too I can hear better than any of you"

Screecher knew now that he could stay here no longer So, without waiting another moment, he spread his wings and flew away The birds screamed at him as he went, but the young owl landed safely in a tree a long way off and quickly hid himself in the heavy foliage

For a long time he sat there, not daring to go to sleep To add to his discomfort, he began to feel hungry once more Ever since he had been hatched from a round white egg, Screecher had always had food in the daytime, for his parents had left worms and insects in the nest where he could find them when he woke up from time to time Now there was no food for him unless he flew to the ground and caught it for himself But screech owls do not hunt in the daytime, and he knew he must wait until the darkness came So he closed his eyes and went to sleep again, and thus time he slept in peace

The twilight had come again when he woke, refreshed by his sleep The other birds had gone to rest, and as he sat blinking his eyes and looking about he felt very contented and happy It was fine, he thought, that he was now old enough to catch his own food, instead of having to wait for his parents to bring it to him And as for the birds who had scolded him, he would take good care after this to hide himself where they could not find him One of these days, when his feathers had grown a little longer, he would be able to fly about through the night without fear He would be able to frighten his enemies and drive them away by flying at them, flapping his wings, and even pecking them with his strong curved beak, as he had often seen his parents do Yes, it was a good thing to be a young owl who could go where he pleased and catch his own food

Tightening his eight strong toes around the branch on which he sat, he looked down at the ground Down there, somewhere in the grass, was all the food that he could eat, but, although he was hungry, he was in no hurry to begin his hunt He had the whole long night before him

An old screech owl flew silently past his tree He could see its body outlined against the twilight—its

round head covered with soft brown feathers, out of which its two great eyes gleamed He could see the soft brown feathers that covered its body thickly, and he watched with admiration as its wings rose and fell without a sound

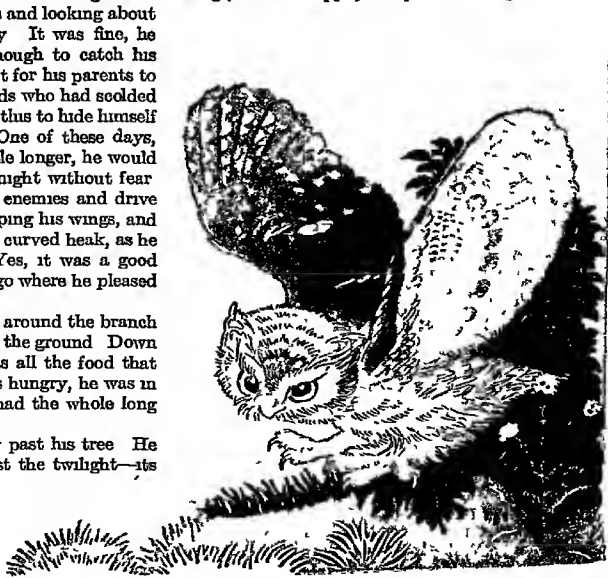
Another screech owl, farther off, sent up its long shivering cry Perhaps it was his mother, Screecher thought, or his father, he did not know And it did not matter much, for now the dark had come and owls were flying everywhere He, too, would fly presently

Again he looked down at the ground, listening intently All of a sudden he swooped Straight down he went, softly and surely And in a moment, his claws had closed around a field mouse

He had done it! He had caught a mouse! He was able now to look after himself, as his parents had said he must How proud they would be!

Flying up to a low branch of the tree, he raised his voice in a long thin cry that rose and fell with a trembling sound From not far away there came an answering cry, and Screecher knew that it was his father's voice

"I will go right now," he thought, "and tell him about the mouse I caught!" And, spreading his wings, he flew happily away into the night.



All of a sudden he swooped
Straight down he went,
softly and surely

'TOWN and GOWN' in OXFORD

For centuries a centre of learning, Oxford still plays an important part in the Empire's life as, equally with Cambridge, a great university city whence come recruits to government, the professions, commerce and the arts

Oxford. Cupped in the hollow of gently sloping hills, held in the embrace of the striding Thames (here often known as the Isis) and its lovely tributary the Cherwell, this famous English city is wrapped in an atmosphere of romance and beauty. To its venerable colleges have come England's youthful statesmen, poets, and philosophers to be nurtured in the traditions of beauty and wisdom.



Tom Tower, Christ Church
Photo A. P. Kersting

The origin of Oxford is lost in the mists of antiquity. It first appears in history about the year 737, when St Frideswide founded her nunnery on the site of Christ Church. Before long a thriving market-town sprang up, which was thrice burned by the Danes. The oldest known architectural remains

are the tower of St Martin's Church (1034) and the castle tower (1071). In this tower the Empress Matilda, daughter of Henry I, was besieged by Stephen of Blois in 1135, and escaped by fleeing over the frozen snow-covered river, clad in white garments in order to prevent detection.

When the University was Founded

Legend attributes the founding of the University of Oxford to Alfred the Great, but the first discoverable traces of organized teaching in the city are about 200 years later, in the 12th century. Either soon flocked students from all over the world, and by the end of the century it had an academic population numbering something like 4,000.

There were as yet no university buildings, no laboratories, no endowments. "Masters" gave instruction—all in Latin—to such students as chose to attend their lectures, and their entire income came from fees collected from their pupils. They were turbulent rascals, these early students, and enlivened their scholastic routine by frequently fighting with the townsmen, so



A WORLD FAMOUS STREET—THE OXFORD 'HIGH'

H. J. Taylor

Here we see a stretch of the High Street, Oxford, with University College on the left. Immediately on the right is Queen's College, and further up are All Souls and Brasenose, with the spire of St. Mary's Church visible between them. University College is the oldest in Oxford, for it was founded in 1249. One of its most famous sons, the poet Shelley, was expelled for writing an atheistic pamphlet.

OXFORD

that the "town and gown" riots of Oxford became proverbial

The friars began building monastic establishments in the 13th century. They came to Oxford in such numbers that they soon aspired to the control of the University. This caused ceaseless strife between the religious orders and the ancient colleges, which was only ended when Henry VIII dissolved the orders. During the civil wars of the 17th century, Oxford became the seat of Charles I and the Royalist court. Several important battles of the period were fought in the neighbourhood of the city.

In organization and methods Oxford University is strikingly different from other universities. It is made up of 21 colleges and one hall, each with its own history, its own income, its own regulations, and its own organization.

The colleges, with the dates of their foundation, are

University	1240	Brasenose (BNC)	1309
Balhol	1282	Corpus Christi	1516
Merton	1264	Christ Church	1525
St Edmund Hall	1266	Trinity	1555
Exeter	1314	St John's	1555
Oriel	1320	Jesus	1571
Queen's	1310	Wadham	1612
New	1379	Pembroke	1624
Lincoln	1427	Worcester	1714
All Souls	1137	Keble	1870
Magdalen (pronounced maudlin)	1458	Hertford	1874

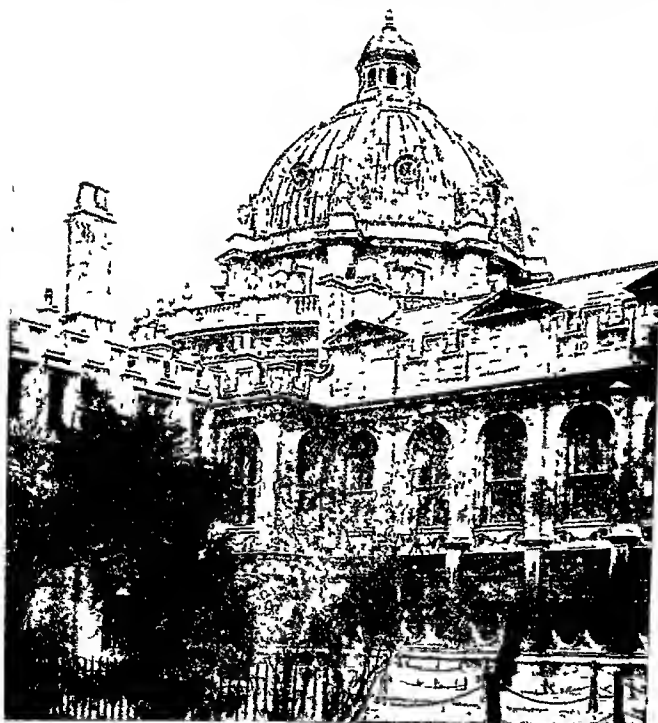
The women's colleges are Lady Margaret Hall, Somerville, St Hugh's, and St Hilda's.

In 1936 Lord Nuffield, whose motor-car works are at Cowley (now a part of the city of Oxford), gave £2,000,000 to endow a new college for medical research, and another £1,000,000 in 1937.

In the centre of old Oxford is Carfax (cross-roads). To the east runs the High Street, as far as Magdalen Bridge. Half-way along "the High" is the University Church, St Mary's. Near by is a group of notable buildings including the newly extended Bodleian Library—the most important in the country after that at the British Museum—the Sheldonian Theatre where many University ceremonies take place, and the old Ashmolean Museum.

The University, which sends two Members to Parliament, is an independent self-governing corporation. Its main functions are holding examinations, conferring degrees, and looking after the discipline of students when outside their colleges. Degrees are open to men and women.

Within the massive semi-monastic buildings of the colleges—each grouped around its own quadrangle of velvety lawn—the students live a life adorned by many curious survivals. On all academic occasions, such as lectures, conferences with tutors, chapel, and dinners "in hall," the undergraduate must



RADCLIFFE CAMERA SEEN FROM BRASENOSSE

The library known as the "Camera" was built by the munificence of Doctor John Radcliffe, physician to William III, who left £40,000 for its erection. Constructed between 1737 and 1749, it was, in 1860, lent to the University as a reading-room for the Bodleian Library, and became so identified with medicine as to be known as the Physic Library.

MAGDALEN'S TOWER BESIDE THE CHERWELL



Where an old bridge carries the London road across the Cherwell, at the foot of Oxford's High Street, stands the shapely tower of Magdalen College, seen above. Magdalen apart from its beauty, is famed for the wonderful music of its chapel, and upon the summit of this tower the choristers greet the dawn with a Latin hymn on May-day morning each year. Magdalen College was founded by William of Waynflete, Bishop of Winchester and Lord Chancellor, in 1458.

Photo J. Dixon Scott

wear his quaint short gown and his "mortar-board" cap. He must be within the walls of his own college before midnight, and he is required to pay a small fine (1d, 2d, or 6d) if he comes in after the great gates are closed at nine o'clock in certain colleges.

Members of the University are in residence only half the year, the terms being three—Hilary or Lent, Trinity, and Michaelmas. Much of the real reading for the degree is done during the six months of vacation. Lectures, essay writing, conferences with tutors, and reading take up from four to six hours of the average man's daily schedule during the term time. The rest of the day is given over to social life and sport, which play a very important part.

Like Cambridge, Oxford awards "Blues" and "half-Blues" to its representatives in sporting events. Oxford are known as the "Dark Blues."

Through the Rhodes Scholarships, students from the overseas Dominions and from the U.S.A. have been brought to the University in far greater numbers than formerly. The population of the city itself is 80,000.

Oxford has been called the "home of lost causes," by which is meant that its dons are usually old-fashioned and out of touch with present-day realities. But history hardly bears out the assumption, for one of the most successful religious movements of modern times takes its name from the University city.

In 1833 a few clergymen at Oxford determined to do what they could to arouse the life and worship of the Church of England from the lethargy into which it had fallen during the eighteenth century. The best-known of these men were John Henry Newman, John Keble, who was already known as the author of "The Christian Year" (1827), and Edward Pusey. In a volume called "Tracts for the Times" they set forth their aims and suggestions, hence their movement became known as

"Tractarianism," though more usually it is called the "Oxford Movement." Some of the ceremonial that they advocated had fallen into disuse in the Church of England since the Reformation, and they were widely attacked for what were regarded as their leanings towards Roman Catholicism. After some years Newman joined the Roman Catholic Church and ultimately became a Cardinal, but Keble remained within the Church of England, and so, too, did Pusey. The last was for long the leader of the "High Church" movement in the Establishment.

Oxford and Asquith, HERBERT

HENRY ASQUITH, 1ST EARL OF (1852-1928). Born at Moles, Yorkshire, September 12, 1852, Asquith was educated at the Molesian School, Pudsey, and the City of London School. Winning a scholarship to Oxford, he had a brilliant career there.

Called to the Bar in 1876, he soon had a large practice, so that at the end of ten years he was able to realize another ambition and stand for Parliament. He was returned in the General Election of 1886 as Liberal member for East Fife, a constituency that he continued to represent until 1918. In 1892, only six years after he entered Parliament, Asquith became Home Secretary, continuing to hold that office until the defeat of his party in 1895.

In December, 1905, he became Chancellor of the Exchequer in Sir

Henry Campbell-Bannerman's Government. He laid the financial foundations of the Old Age Pension scheme, while he was the first Chancellor to vary the rate of income tax for earned and unearned incomes.

On the death of Campbell-Bannerman in 1908, Asquith became Prime Minister with Mr. Lloyd George as his Chancellor of the Exchequer. He succeeded in compelling the House of Lords to pass the Parliament Act, which greatly curtailed their powers, and at the same time his Government passed many measures of social reform, the most important of which were the



EARL OF OXFORD MAKES A SPEECH

This photograph shows the great Liberal statesman making an election speech in the days when he was plain Mr. Asquith. On his right his colleague and later rival, Mr. Lloyd George, is sitting, and beyond him is Mr. Asquith's wife, Margot, now Countess of Oxford and Asquith.

Old Age Pensions Act (1908), the Trade Boards Act (1909), the Labour Exchanges Act (1909), and the National Health Insurance Act (1911).

On the outbreak of the World War in 1914 Asquith defended British intervention in a series of speeches remarkable for their lucid statement of fact and logical argument. In the conduct of the war, however, he appeared to lack the driving force so essential at such a time. He first met criticism by forming a coalition with the Conservative and Labour parties, but a revolt of some of his colleagues led him to resign in December 1916, when Mr Lloyd George became Prime Minister. Asquith was defeated at East Fife in the general election of 1918, but two years later he was elected for Paisley, which he represented until he was defeated again in 1924. He was then made a peer. He died on February 15, 1928.

By his first wife Lord Oxford had four sons and a daughter. She died in 1891 and three years later he married Emma Alice Margaret (Margot), daughter of Sir Charles Tennant, Bart. Lord Oxford's eldest son was killed in the War, and he was succeeded by his grandson.

Oxfordshire. This inland English county (known for short as Oxon) has an area of 743 square miles and lies mostly in the basin of the Thames, which is its southern boundary.

A great part of the county is flat, but there are some hill ranges and broad well wooded valleys. Across the south stretch the Chiltern Hills, which rise to 800 feet, and in the north west the highest ground is in the Cotswold Ridge. Besides the Thames, the principal rivers are its tributaries, the Windrush, Evenlode, Cherwell, and Thame. In the vicinity of Oxford the Thames is frequently known as the Isis.

Agriculture is the chief industry. Wheat, barley, oats, and beans and other vegetables are grown, and cattle, sheep, and pigs are raised, Oxfordshire brawn being noted. There are manufactures of lace, gloves at Woodstock, agricultural implements at Banbury, blankets at Witney, and paper.

Apart from Oxford itself, Oxfordshire is very rich in fine churches, among which may be mentioned the wonderful Norman church at Iffley and the great church at Bloxham. Among its great houses is Blenheim, presented to the Duke of Marlborough for his victory at Blenheim in 1704. There is much beautiful scenery along the Thames, Henley being a favourite riverside resort, whose annual regatta is world-famous.

The county town is Oxford (*g v*), and other of the more important towns are Banbury, Thame, and

Witney. The county's total population numbers about 209,600 persons.

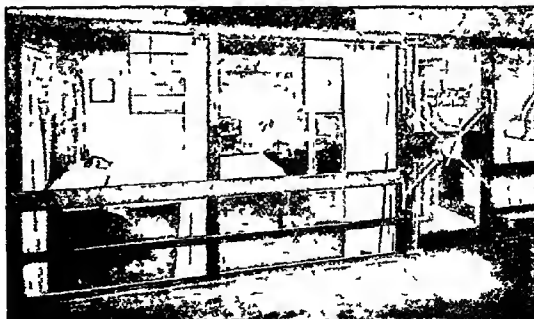
Oxygen. What do you suppose is the most abundant substance in the world and the most widely distributed? It is oxygen, which exists as an uncombined gas in the air we breathe, and in combination with other chemical elements forms water, sand, limestone, and other rocks, iron rust, sugar, cloth, paper, and so on. Free oxygen makes up one fifth of the atmosphere.

In its free state oxygen is a gas without colour, odour, or taste. Oxygen, however, is very active chemically, and readily enters into combination with nearly all other elements. Sometimes heat promotes this chemical union, and sometimes moisture, as in the rusting of an iron nail. When wood burns, the oxygen of the air unites rapidly with the carbon and hydrogen of the wood, for, chemically, "fire" is only the rapid oxidation of a substance.

When oxygen unites in combustion with hydrogen, water is formed. It is easy to prove this, for if a piece of cold chinaware is passed swiftly over a flame of any sort (such as a gas flame) drops of water formed from the hydrogen and oxygen of the air will be found on it.

Oxygen is necessary for all animal life. Nitrogen is necessary, too, but oxygen has a different use. It may be hard to believe that our bodies are being "burned" all the time, but this is a fact. The food we eat is oxidized or "burned up" by the oxygen in our blood to provide energy and heat. The oxygen reaches the blood in the lungs from the air we breathe, so now you see why deep breathing of fresh air is essential to appetite and digestion.

Oxygen, as a chemical element, was discovered in 1774 by Joseph Priestley (*g v*), an



OXYGEN THE LIFE SAVER

In this glass-walled room at Guy's Hospital, London, fitted with a special air-lock double door, patients suffering from pneumonia can be kept in an atmosphere of oxygen and easily observed. The carbon dioxide formed by the patient's breathing is drawn through a special chamber.

OXYGEN

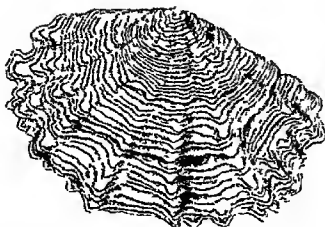
English chemist, independently of, and a year later than, the Swedish chemist Scheele Lavoisier, a French chemist, soon after this, devised some experiments which proved that the oxygen discovered by Priestley was an important component of the air, and that it combined with metals to form rusts, or "oxides" as the chemists call them. Lavoisier also proved the part oxygen plays in combustion.

A large quantity of oxygen may be compressed into a small, strong steel cylinder in this way a convenient supply of the gas is obtained. This is how oxygen is easily carried from place to place for use in reviving very ill people, or in oxy-acetylene welding.

Free oxygen generally forms itself into molecules, each consisting of two atoms of the gas (O_2). There is another form—or "allotrope," as the chemists call it—named "ozone," which consists of molecules, each made up of three atoms (O_3). This is produced by passing electric sparks through ordinary oxygen. It has a peculiar and distinctive smell, is a powerful and rapid oxidizing agent, attacking rubber and cork, and is used sometimes as a germicide. Natural ozone is found in the atmosphere at high altitudes, due to the action of lightning.

Oyster. These shellfish are among the most extensively eaten of all sea foods, and the oyster industry is one of the most valuable of those that utilize the sea's products. Oyster fisheries in 35 countries engage 150,000 men and women, and vast sums of money are invested in them.

Oysters live in beds in the shallow waters along the shores of



THE GREAT PEARL MAKER

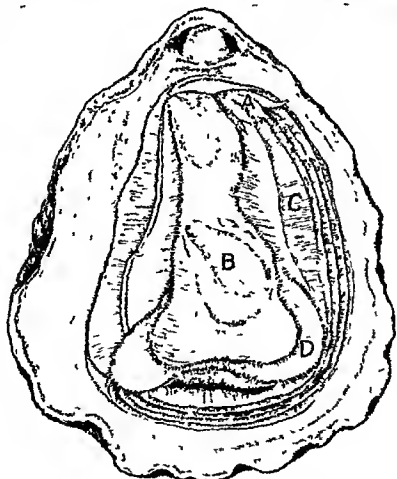
While pearls have been found in every variety of oyster, the genuine pearl oyster is found principally in the East Indies. It is often eight to ten inches in diameter.

important oyster fisheries in Holland.

Varying greatly in size, shape, habits, flavour, and food value, there are about 100 species of oysters. The three most important are the common European oyster (*Ostrea edulis*), the Japanese oyster (*Ostrea cucullata*), and the species found along the eastern coast of North America (*Ostrea virginiana*).

With their relatives, cockles, mussels, and scallops, oysters belong to the group of molluscs known as *Lamellibranchia* (See Molluscs). The pearl oyster belongs to a different family, as do also the freshwater types.

The eggs hatch and the young begin to swim in a few hours, and at the end of a day have formed a tiny bivalve shell. The newly hatched oyster, called larva or "spat," is a free-swimming creature, sometimes carried long distances by tides and currents. But most of the spat fall a prey to underwater enemies, or are suffocated in the mud or under-sea growth. After a few weeks the survivors attach themselves permanently to rocks or other submerged objects and quickly lose the swimming organ and the foot as well.



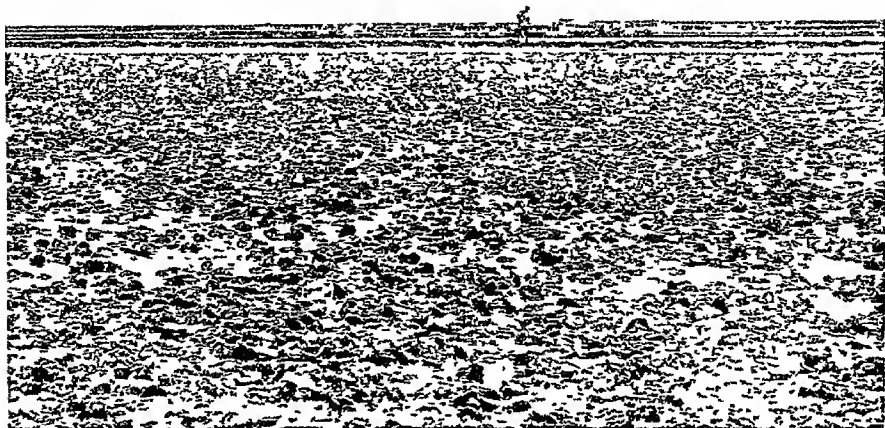
ANATOMY OF THE OYSTER

The mouth is formed by two sets of labial palps (A). The position of the adductor muscle (B) is shown on an empty shell by a dark patch, marking the spot where it was attached. It is with this muscle that the oyster holds its shell closed so tightly. The gills (C) project into the mantle (D), which is the body wall.

OYSTER

temperate and tropical oceans and seas, but the supply in the North Atlantic exceeds that of all other waters combined. In Europe oysters are found from Norway to the eastern Mediterranean and the Black Sea. In Great Britain the Thames estuary is the most important oyster region, Whitstable, Colchester and Brightlingsea, all within easy reach of London, being the chief centres. In France the principal oyster centres are Arcachon and Brittany and, in addition, there are

HOW OYSTERS ARE GROWN & COLLECTED



The top picture shows an oyster bed at low tide. When oyster beds are planted in shallow tidewaters near the shore, it is easy for the oyster farmer to gather those which have reached the proper size. Such an arrangement is really an under-water farm, for the owner seeds the area with young oysters and guards them from enemies until they are ready for market. Beds like these exist under the shallow waters at Whitstable near the estuary of the Thames and in the lower picture oyster fishermen at Whitstable are seen examining specimens which they have raised in the nets resting on the boat's side. They are selecting oysters for testing their quality before the season opens on September 1.

OYSTER

Ordinarily the shell is oval, and somewhat enlarged at one end and has two halves or valves, which open and close at the hinge. The half which attaches itself to the submerged object becomes hollowed out as it grows, in order to accommodate the growing oyster's body, but the upper half is flattened, or even pushed in from above.

The soft body of the oyster is attached to the shell by a stout muscle, which extends from one valve or half of the shell through the animal's body to the other valve, and enables the oyster to close its shell tightly. A fold called the mantle grows from each side of the oyster's body, completely lines the shell, and secretes new shell. Two folds conceal the mouth, and other very large flaps form the gills.

Throughout its life the oyster is attacked by hordes of enemies. Many young swimming oysters are consumed by the adults and by fishes. Starfish, moving over the bottom in great armies, destroy several hundred thousand bushels of marketable oysters in a season.

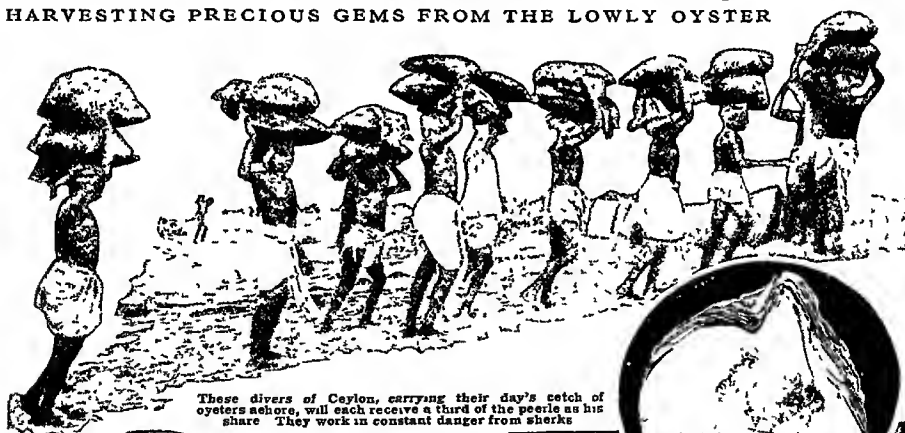
forcing the valves apart or boring in through the shells. Among other oyster enemies are fish armed with crushing teeth, and sponges which burrow into and riddle the shell.

The oyster has been under culture longer than any other water creature. A simple type of cultivation, with the formation of artificial beds, flourished in China at a very remote period. In Italy oyster culture began about 100 B.C. In the important maritime countries of Europe fully 90 per cent of the output now represents artificial cultivation.

Perhaps the most elaborate system of oyster culture is that adopted in France. The spat is collected usually on tiles placed near the spawning bed. The "seed" oysters are removed to partly enclosed ponds, which admit the tides through sluices. When fully grown, the oysters are fattened and flavoured in small enclosed ponds called "claires."

The Japanese oyster farms are in shallow brackish water where the low tides leave large areas of muddy beach exposed.

HARVESTING PRECIOUS GEMS FROM THE LOWLY OYSTER



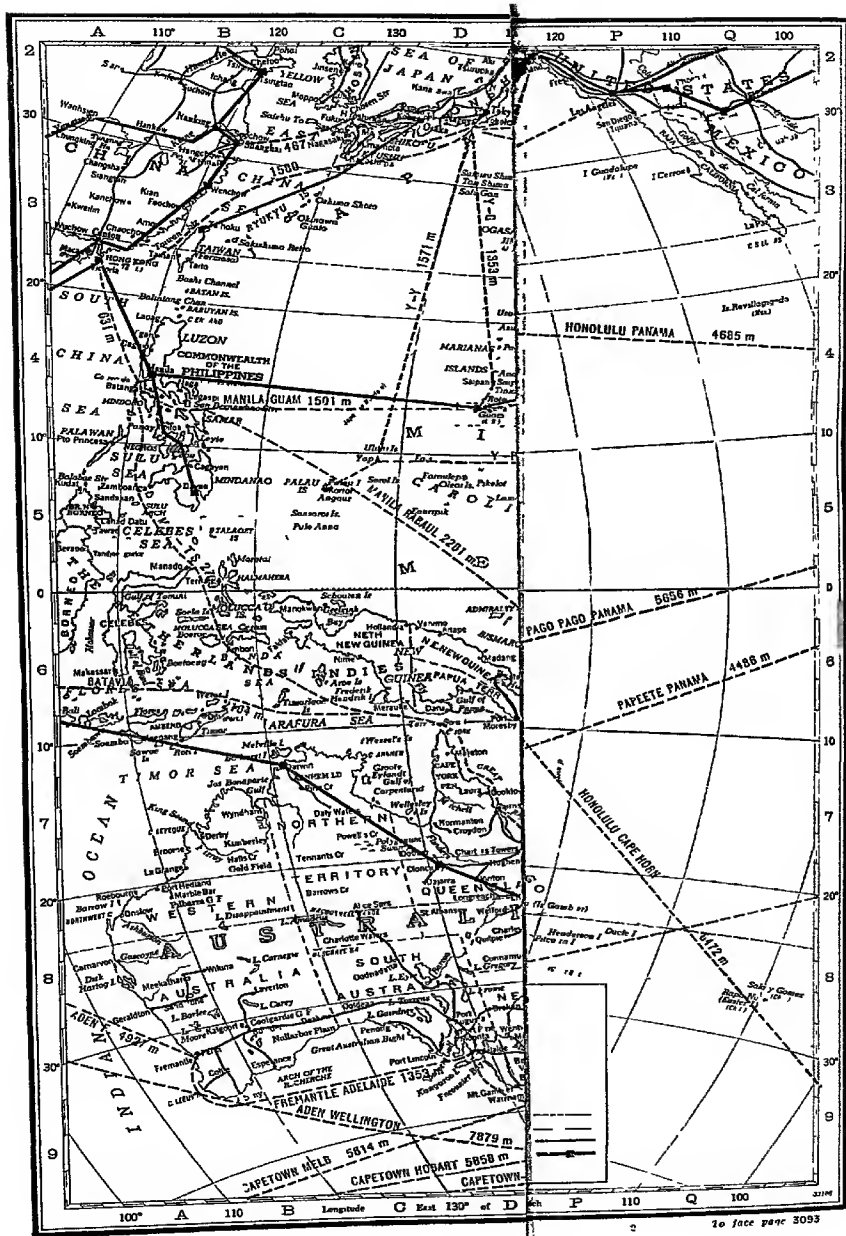
These divers of Ceylon, carrying their day's catch of oysters ashore, will each receive a third of the pearls as his share. They work in constant danger from sharks.



The oysters are allowed to decay, then they are carefully picked over for even the tiniest pearls. The old chap on the left hopes for a rich reward.



In the circle is shown an oyster shell which formed some hollow "byster" pearls while it was repelling a boring parasite. Perfectly round or pear-shaped pearls are the most valuable, the mass shown above is worth a fortune.





ONE of the Egyptian hieroglyphs was a shutter B. This developed into the character which was borrowed by the Phoenicians. They called it *Pe* "mouth" perhaps because they thought it looked like a mouth with teeth. When they themselves wrote it they simplified it so that it is hard to see the resemblance to a mouth but they still kept the name. The Greeks used the same form, but turned the hook to the right. They afterwards squared the top thus P and finally made the two legs of equal length in the character Π which became the modern Greek letter Π. The Romans adopted the rounded form P which they curved more and more, until finally the semi-circle was closed exactly as in our letter P. The name, you will note, has changed very little, and the same is true of the sound which is formed by closing the lips for an instant and then allowing the breath to escape through them explosively. In certain words in English e.g. *palm*, *psychic* *p* is mute

Pacific Ocean. Stretching 9,300 miles from the Arctic Circle at Bering Straits to the frozen seas of the South Polar zone and nearly half-way round the earth along the Equator, from the coast of South America to the tip of the Malay Peninsula, this giant of waters occupies one third of the globe's surface, a region of mystery and adventure larger than all the land area of the world.

It is the deepest of oceans averaging two and a half miles, and reaching its maximum near Mindanao, where yawns a watery chasm measuring 35,400 feet—6,393 feet deeper than Mount Everest is high. It washes the shores of four continents—Asia, North and South America, and Australia—and its waters mingle in the south east with the Atlantic Ocean, and in the south west with the Indian Ocean.

Romantic Realm of the South Seas

But it is not on the shores of America or of Asia or of Australia that you will find the soul of the great Pacific. It lies far out where those fabled "South Sea Isles" are scattered over the vast expanse like stars in the sky. There, where the monster fires at the heart of the earth have thrust great mountains and volcanoes above the waters, and where tiny coral creatures with ceaseless labour have crowned the ocean with countless coronets of rainbow hues, the fairyland of dreams almost comes true.

The very air that sweeps these islands is fragrant with flowers and spice. Bright warm days and clear cool nights follow each other in eternal procession, while the rolling swells break in never-ending roar on the dazzling

shores, and overhead the slender coconut palms whisper their drowsy song. Truly this great sea deserves its name given by Magellan, of the Pacific or "peaceful" Ocean.

When white men first landed on its islands the inhabitants were like happy children who never grew up. Tall, magnificent men and handsome women they were for the most part, and apparently they had not a care in the world. Coconuts and bread-fruit grew wild at the doors of their huts. The surrounding waters were filled with turtles and fish, ready for the net. For clothing they had little need. Disease was virtually unknown.

The first explorers frequently became so fascinated that they forgot their homes and settled down among the natives for the remainder of their days. But today the peoples who used to live in such care-free happiness are rapidly vanishing.

On certain islands where a hundred years ago thousands lived, a few score perhaps remain. Diseases were left in the wake of the

BALBOA'S FIRST VIEW OF THE PACIFIC



Balboa was the first white man to gaze upon the waters of the Pacific Ocean. Standing upon a peak in the Isthmus of Panama on Sept. 25, 1513, he sighted the "Great South Sea," and some days later reached its shore, taking possession of it in the name of Spain.



PUZZLING RELIC OF A VANISHED RACE

In the wild bush country of Tongatabu, a small island in the South Pacific, stands this solitary, massive gateway, formed of two immense blocks of stone with a third laid across and cleverly mortised into the uprights. No one knows either its origin or meaning, or what purpose it served. Remarkable remains of prehistoric people are constantly coming to light in the thick bush of the South Sea Islands.

great sailing vessels or in the trail of the steamers' smoke. The bodies of the islanders, from time immemorial free from the attack of disease, had slight power to resist sickness, so they fell, and continued to fall, easy victims to the scourges of civilization.

Scattered through the island groups, from one side of the ocean almost to the other, are found the remains of an ancient race of skilled builders. Ruins have been discovered of huge altars, tombs, and dwellings built of great blocks of stone carefully fitted together without mortar. Traces exist in some places of houses built out over the sea, of canals, and of gigantic piers and breakwaters.

On tiny Easter Island (*q v*), over 1,000 miles from any other inhabited island, are found great walls and platforms thirty feet high, surmounted

by pedestals upon which once stood colossal statues, now lying near by. These statues, crumbling with age, still show resemblance to the human form. The largest is thirty-seven feet high, and in a quarry on the other side of the island is a figure half cut out from the volcanic rock, which measures seventy feet. On some of the stones are traced geometrical figures and the shapes of animals. Some of these statues are now at the British Museum. Who were these builders, whence did they come, and whether did they go? The natives who lived on these islands when the white men first arrived knew no more about the mystery than we do.

The western shores of the Americas are remarkably unbroken, the coast islands off southern Chile, the Gulf of California, and the long chain of Aleutian Islands off Alaska being the only important features.

Almost the only other deep-sea islands are the Galapagos and the Juan Fernandez groups.

To this shore-line the coast of Asia presents a great contrast. It is broken by numerous great bays and land projections, and is skirted by a series of large islands, which mark off parts of the Pacific important enough to be named as separate seas. From north to south these are Bering Sea, bounded by the Aleutians, the Sea of Okhotsk, set off by the peninsula of Kamchatka and the Kurile Islands, the Sea of Japan, between the islands of Japan and the mainland, the Yellow Sea, formed by Korea, and the China Sea enclosed by the coast of Indo-China, the Malay Peninsula, the island of Borneo, and the Philippines.

The waters between the south-eastern corner of Asia and the continent of Australia are

crowded with a group of large islands, variously called the East Indies or Malaya or the Malay Archipelago. The Philippines and Borneo have been mentioned. The others are Sumatra, Java, Celebes, and New Guinea. These, as well as New Zealand, are not usually classed as Pacific islands, their story is told under their separate names. (See also East Indies)

The smaller Pacific islands, often called by the general name of Oceania, form a sort of watery "Milky Way" 8,000 miles long, from Japan and the Philippines to distant Easter Island. They are mostly divided up into clusters or groups, each with its own name. These groups in turn fall into three great divisions, according to their position and the character of their native population.

Islands of Melanesia

The first division is Melanesia ("islands of the blacks"), forming a long crescent of fairly large islands, stretching from the coast of New Guinea south eastward towards New Zealand. The principal groups in Melanesia are the Bismarck Archipelago, including New Britain and New Ireland, with their batteries of active volcanoes, the Solomon Islands, where dwell the most savage and uncivilized cannibals, the Santa Cruz Islands, where many early missionaries fell victims to poisoned arrows, the New Hebrides, with their government conducted jointly by France and Great Britain, and, at the end of the crescent, the large island of New Caledonia, an old French convict colony, and the Loyalty Islands.

The natives of Melanesia are for the most part negro like in appearance, with thick lips, very dark skin, and curly hair. They are closely related to the Papuans of New Guinea. Their social and political customs are crude, but they have all the negro's skill in savage arts. They are industrious and energetic.

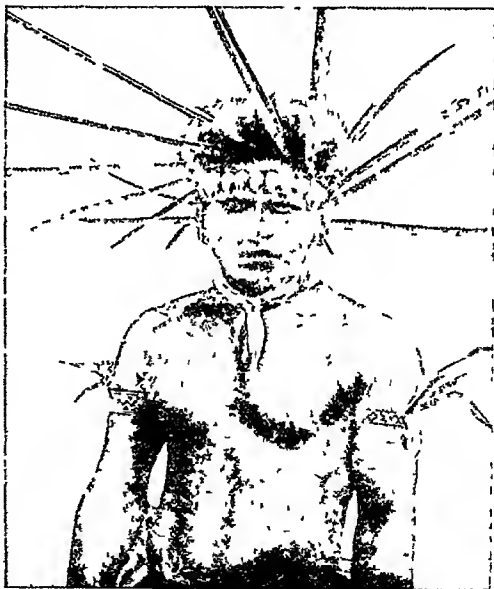
North of Melanesia lies the division called Micronesia ("small islands"). This consists of close packed groups of tiny islands—some of volcanic origin, others merely atolls, as the peculiar ring shaped coral islands are called. The principal groups are the Marianas or Ladrões to the north, the Pelew Islands, with their amazingly fertile soil, the widely scattered Caroline Islands, famous for their strange prehistoric ruins, the Marshall Islands, where dwell the holdest and most skilful navigators of the Pacific, and the crowded Gilbert Islands, formerly noted for the fierce cruelty of their inhabitants.

In general the natives of Micronesia are of mixed black, brown, and yellow strains, for Malay and Chinese characteristics

minge with strong traces of Papuan blood. But these peoples are generally more handsome and of higher intelligence than the Melanesians.

The remaining great groups of islands, which occupy the centre of the Pacific fall into the division called Polynesia ("many islands"), and it is among these that the true South Sea romance dwells. The Polynesian men are among the tallest in the world, averaging on some islands six feet in height. The women are often surpassingly beautiful. The race is light brown in colour, with straight black hair, and some scientists trace it to the same Caucasian stock in the New Stone Age from which the white race of Europe sprang. The intelligence of these Kanakas, as they are sometimes called, is high, and their manners are excellent. In their happy and indolent life they long ago lost the desire to work, as well as much of their skill in manual arts, but their political and social organization was the highest in the Pacific.

The chief groups of Polynesia are the Hawaiian, Fiji, and Samoan Islands. (Each of these is described in a separate article.) Of the



SOUTH SEA ISLAND HAIR STYLE

The natives of the Marquesas are of pure Polynesian race, and physically among the finest of all South Sea islanders. They are a friendly race, and as can be seen from the photograph, fond of extravagant fashions in arranging their hair.

other groups the most important are the Ellice Islands, chiefly of coral formation, the Tokelau Islands, whose inhabitants are perhaps the holdest swimmers in the world, parties of men and women frequently pushing out into the open sea and attacking man-eating sharks with no other weapons than long knives, the Tonga or Friendly Islands, with their wonderful political organization under native rulers, the Cook Islands, one of the most picturesque groups in the Pacific, the Society Islands, including beautiful and romantic Tahiti, famed for the songs and poetry of its people, the Tuhua or Austral Islands, famous for their native sailors, the Tuamotu or Low Archipelago, consisting of innumerable coral islands noted for their shell fisheries, and, last of all, the Marquesas Islands, whose natives are said to surpass all other islanders in beauty, but whose population has been reduced by disease from 50,000 in 1850 to less than 3,500 today.

The religion of most of the Pacific islanders was marked by strong superstitions and faith in magic. Most conspicuous was the widespread practice of *tabu*, or religious prohibitions. This was often used in place of laws to protect the persons of chiefs, to safeguard crops, to shut out the people from certain temples or houses, and for scores of other purposes. (See Magic).

Modern scientists believe that these peoples came from the mainland of Asia, some 3,000 years ago or more, passed through the Malay Archipelago, and thence made their way in great canoes to the outlying groups. The prehistoric builders were perhaps exterminated or driven away. One theory connects these Polynesian peoples with the Inca race of Peru.

A great contrast exists between the coral atolls and the volcanic islands of the Pacific. The ring- or horseshoe-shaped atolls, which may be from one to 100 miles in circumference, are low, sometimes rising only a few feet above the surrounding waters. They are fringed with coconut palms, and here and there in the shallow soil grow pandanus trees, which provide not only a fruit, but timber, dye, and leaves for

thatching and making hats. Rats and land crabs are the only animals, but the surrounding waters teem with varied fish.

The coral reef usually has one or more openings, leading to the lagoon within, which forms a natural harbour. In the lagoon, too, fish abound, but for some reason their meat is frequently poisonous, though the same species caught outside the lagoon will be safe food.

The volcanic islands have an altogether different appearance. Their sharp rocky mass rises suddenly from the sea, often to great altitudes, forming impressive mountains, whose rough outlines are softened by a dense growth of luxuriant vegetation. Here rain is more abundant, and the rich soil supports countless valuable plants and trees—the taro, whose roots, ground into paste and allowed to ferment, form the famous native dish called *poi*, the banana, yam, sago-palm, and the indispensable bread-fruit. Here also grows the paper mulberry, whose inner bark is pounded into *tapa* cloth, so widely used for mats and clothing throughout the islands. Wild pigs and goats, descendants of those set free by the early explorers, overrun many of the larger islands, and unnumbered herds of bright-plumaged dwell in the forests of the interior.

But everywhere, on islands large or small, the coconut palm waves its plumes over the land where it remains king. This palm is the fairy godmother of the native. It gives him food, drink, a roof for his house, and fibre for his baskets, ropes, and fishing-nets. And, in addition, the dried coconut kernel, called *copa*, is the chief article of island trade, and often takes the place of money in business transactions among the natives.

Another valuable article of commerce is trepang or *hêche-de-mer*, highly valued as food by the Chinese. It is prepared from the dried bodies of certain large sea slugs.

In recent years many of the western Pacific islands have been found to be composed largely of phosphate of lime, highly prized as a fertilizer, and this has been dug out and exported on a



BELLE OF THE PACIFIC

The women of Tahiti are no less enchanting than the luxurious vegetation of that romantic island of the South Seas. Here we see a typical maid of Tahiti, like a fairy emerging from a flower-bud in a pantomime "transformation scene".



LEAFY PALMS AND PLACID WATERS AMID THE PACIFIC

Scattered in the vast Pacific Ocean are numbers of small coral islands crowned with palm trees. When formed in the shape of a ring they are known as atolls, and Nissan Island, in the Bismarck Archipelago, from which this photograph was taken, is an excellent example. Although 9 miles in length it is only about a mile wide, and encloses a 7-mile-long lagoon of clear tranquil water. When the ring is broken, as in this instance the island takes the shape of a horseshoe.

Photo Royal Australian Air Force.

large scale. Several of the bigger islands yield important quantities of metal ores. New Caledonia, for instance, is one of the world's chief sources of nickel.

The climate of the central Pacific is generally very equable, for the natural heat of the tropics is tempered by the constant ocean winds. But in the west typhoons and hurricanes frequently do great damage, and occasional tidal waves, set in motion by submarine volcanoes, sweep over the coast settlements.

The first European to see the Pacific was Vasco Nuñez de Balboa, who in 1513 glimpsed it from a mountain top in the Isthmus of Panama. Seven years later Ferdinand Magellan sailed round South America and crossed the Pacific to the Philippines, where he was killed. He sighted few islands on the way, and stopped only at the Marianas. As early as 1512 the Portuguese were entering the Pacific from the western side, following Vasco da Gama's voyage round the Cape of Good Hope.

Little was accomplished, however, in the way of wider exploration until the 17th century, when the Dutch entered the field, in the person of Abel Tasman, and explored Tasmania (Van Diemen's Land), New Zealand, the Tonga

Islands, the Tuamotu group, and the Bismarck Archipelago. In the following century Jacob Roggeveen explored Samoa and the neighbouring islands. Samuel Wallis and Philip Carteret, in 1766, acting for Great Britain, and De Bougainville for France, carried out other important voyages of discovery.

The greatest of all these explorers, however, was Captain James Cook (qv), who between 1769 and 1778 made three long trips, visiting nearly all the important eastern groups, including the Hawaiian Islands, where he was killed. Vancouver and many others followed, and before very long the period of actual discovery and exploration of the Pacific islands was succeeded by one of scientific study.

In the second quarter of the 19th century numerous scientific expeditions were organized to study the formation and the life of the Pacific Islands, the most famous being those of Charles Darwin, in the British warship *Beagle*, and Alfred Russel Wallace. On their heels came traders, seeking copra, trepang, pearls, tortoise-shell and sandalwood. Whalers and sealers also visited the islands.

Deserters and shipwrecked sailors often settled down in the more hospitable islands,

PACIFIC

defrauding the inhabitants in trade and exerting evil influences on island politics. These thriftless men, who lived from hand to mouth on the bounty of the natives, came to be known as "beachcombers."

The practice of kidnapping natives for the South American and Australian labour markets, which prevailed for many years, led to numerous conflicts with the island tribes. Together with the activities of the beachcombers, these made exceedingly difficult the task of the missionaries, who began their work among the islanders at an early date. Today virtually all the inhabitants of Polynesia and Micronesia profess Christianity.

One of the most romantic tales of the Pacific centres about Pitcairn Island, a tiny isolated rock rising 2,000 feet from the sea, south-east of the Tuamotu Archipelago. Here, in 1790, nine mutineers from the British ship *Bounty*, accompanied by six Polynesian men and 12 Polynesian women, sought refuge from the law. They burned their vessel and started to build homes. Disorder and bloodshed followed, and within ten years only one Englishman, John Adams, with eight women and a number of children were left alive. When this strange

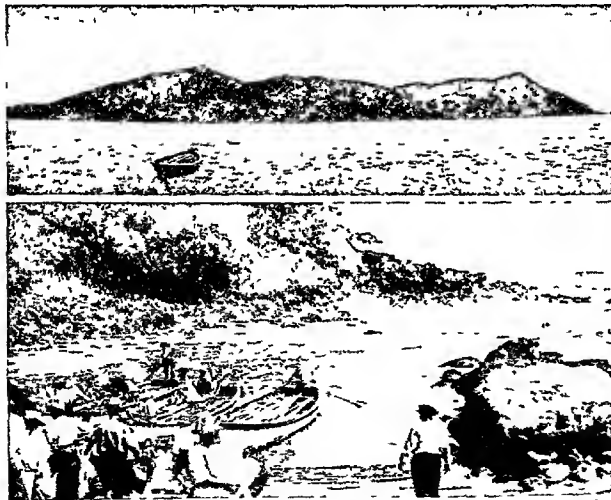
colony was discovered, in 1808, Adams had restored order and Christianized his people. The island was annexed to Great Britain in 1839, and 17 years later its people, about 200, were removed to Norfolk Island, north-west of New Zealand, but several returned later. Today Pitcairn has about 200 inhabitants, mostly descendants of the original settlers.

The principal groups of Pacific islands are divided among four great world powers. Before the World War Germany had several of these groups, but in the peace settlement the German dependencies were mandated to Japan, Australia, and New Zealand. Great Britain directly administers the British Solomon, Gilbert, Ellice, Phoenix, Fiji, and Tonga groups. Australia has the Bismarck Archipelago and the former German Solomons. New Zealand has Western Samoa and the Cook, Chatham, Auckland, Kermadec, and Union (Tokelau) islands. France has New Caledonia and the Loyalty, Wallis, Society, Tuamotu, Marquesas, Leeward, Gambier, Tubuai, Rapa, and Makatea islands. The New Hebrides are a British and French condominium; that is, they are under joint French and British control. Japan has the Marianas, Marshall, Caroline, and Pelew islands. The

United States has Guam, the Hawaiian islands, and the American Samoa islands.

The air conquest of the Pacific has given new importance to some of the islands, as airports and refuelling bases. There is a regular flying-boat service operated by an American company from San Francisco to China, with stops at Honolulu (Hawaii), Midway Islands, Wake Island, Guam, and Manila. A branch line is to be opened to New Zealand.

Commercial rivalry among the great nations for the vast potential trade of the lands on the west coast of the Pacific has caused international problems of grave importance. Japan has announced a "Monroe Doctrine of the East," which would make it the sole arbiter in this region. Great Britain, Russia, France, and other European nations have vast commercial interests here, which are threatened by Japanese domination. The United States, too, is concerned, to maintain its commercial rights and ensure the security



SETTLED BY MUTINEERS FROM THE BOUNTY

Pitcairn Island lies roughly midway between Auckland, New Zealand, and Lima in Peru, and is peopled by descendants of the mutineers of H.M.S. *Bounty*. The upper photograph gives a general view of the island, which is of volcanic origin, while the lower one shows the only landing place for boats. Discovered in 1767, the island takes its name from a midshipman who first sighted it.

PACIFIC

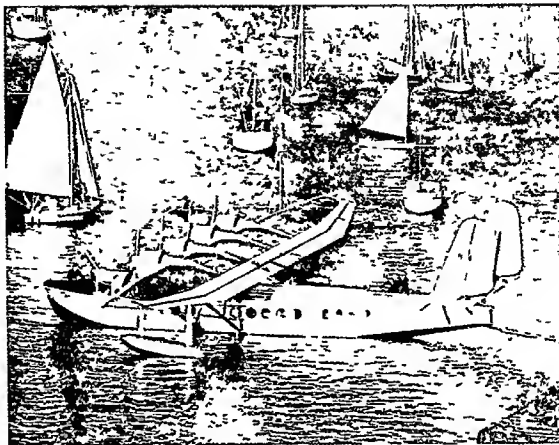
of its Pacific island possessions and its continental sea-board. Hence developments that menace the peace in this area are of grave concern to the whole world. These problems are primarily of the 20th century, although their historical roots go deeper. The opening of the Panama Canal in 1913 revolutionized both the commercial and the naval strategy of the whole Pacific region.

Paderewski,
IONAZ JAN (Pron pad - er - ef' - ski)
(Born 1860) As musician and as statesman, Paderewski has a unique place in history. Long recognized as the world's greatest living pianist and as a composer of note,

he was also an ardent Polish patriot.

Paderewski was born of a noble family at Kurylonka, a little place in Russian Poland, and was educated in Warsaw, the Polish capital. He began to play the piano at the age of three, and when 17 years old he made his first concert tour. Later he became a pupil of Leschetzky, a famous Polish teacher of the piano in Vienna, and in 1889 appeared at concerts in Vienna and Paris, taking his audiences by storm. A series of triumphs in London and America was followed by the verdict that, since Liszt, no greater pianist had been known.

During the World War Paderewski and his wife organized and supervised relief work for war-devastated Poland, and he directed the formation, equipment, and training of an American-Polish



U.S. World Photos

END OF A NEW PACIFIC TRAIL

High adventure, achievement and tragedy have been enacted in the vast expanse of the Pacific Ocean through the centuries. Here is shown the culminating triumph of an endeavour of modern times—the arrival at Auckland Harbour in 1937 of an American flying-boat after her 7,000-mile flight from her homeland. The aerial link thus welded presaged the establishment of a four-day service between New Zealand and the United States.

legion to fight on the side of the Allies. Largely through his efforts the Allies declared in favour of "a united independent Polish state, with access to the sea." Returning to Warsaw after

the Armistice, he was able to unite the Radical and Conservative elements in Poland in support of a representative form of government by all classes, and was made the first Premier of Poland in January, 1919. He presented the case of Poland to the Peace Conference in Paris, voicing and interpreting the political spirit of his countrymen as he had before interpreted the spirit of Poland in music. He, however, retired from the Premiership before the end of the year.

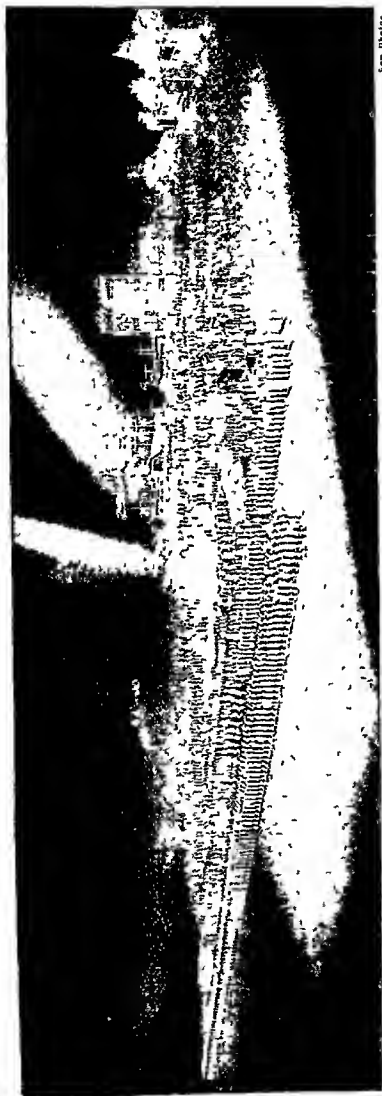
Paderewski's compositions include an opera "Manru," produced in 1901, a suite for the orchestra, and numerous piano pieces.



PADEREWSKI THE PATRIOT

Hailed everywhere as the greatest living pianist, Ignaz Paderewski has long been regarded as Poland's most distinguished son. Besides his eminence as a musician, he has also had a distinguished political career, for he was Poland's first premier and in 1919, presented his country's case at the Peace Conference in Paris.

Photo: Donald W. Graham



see photo

FINALE OF THE FLOODLIT PAGEANT OF THE ALDERSHOT TATTOO

The annual military pageant known as the Aldershot Tattoo attracts many thousands of spectators to the Rushmore Arena, a natural amphitheatre, not far from the town of Aldershot. The striking photograph above, taken during a full-dress rehearsal of the 1930 Tattoo, shows well the effectiveness of the lighting and general display.

Pageant. The spectacular pageants so frequently employed today to commemorate historic events and personages are no older than the 20th century. They took their rise from the rebirth of the dramatic spirit in the last generation. (See Drama)

The pageants of the Middle Ages contained the germ from which the modern pageant was developed, but these old-time spectacles were only elaborate processions. They were like the modern pageant in that their aim was usually to recall the glorious events and personages of bygone days, but they were in dumb show.

The famous spectacle given at Sberborne, in Dorsetshire, in 1905, which owed its chief inspiration to Louis N Parker, a well-known playwright, marks the beginning of modern pageantry. The idea took root at once, and within a few years dozens of similar spectacles were produced in various parts of the country. At first the only type was the pageant of local history, and this still remains the most popular.

But the new dramatic form showed itself to be so vital that it has already given birth to such widely differing types as the masque, the civic festival, various school celebrations, and the anniversaries of famous men and events. Educationists have been quick to see the tremendous power of such semi-dramatic productions in focusing interest on history.

Whether the form be the historical pageant, the allegorical and symbolical masque, the civic festival, or the school play, the basic and essential idea in all is the expression of community spirit. As in the pageants and plays of the Middle Ages, the whole community is expected to take part in some way, either as performers or in assisting in the work of production, or merely as spectators.

In recent years there has been a great revival of interest in the historical pageant. Following in the footsteps of Louis N Parker came Frank Lascelles (d 1934), who organized such successful pageants as the Festival of Empire and the Coronation Durbar, in pre-War years, and the Pageant of Empire in connexion with the Wembley Exhibition.

In the summer of 1933 came the Greenwich Night Pageant, and in the following year the Pageant of Parliament at the Royal Albert Hall, and the Pageant of Runnymede. Over five thousand players, mostly recruited from local villages, took part in the latter under the direction of their woman Pageant Master, Gwen Lally. The Jubilee year of King George V (1935) saw several remarkable displays, including the Pageant of England at Slough and the Tower Pageant and Tattoo.

Mention of tattoos reminds us of the annual Aldershot Command Searchlight Tattoo, the greatest of all military displays and a superb

blend of historical pageantry and modern efficiency (Tattoo, from meaning the call by drum and hugh of soldiers back to their quarters for the night, has come to mean a military fête held at night) The Londoner's own pageant is the Lord Mayor's Show (held as a rule on November 9), in which some of those taking part are usually dressed in old-time costume

Paine, THOMAS (1737-1809) Born at Thetford, Norfolk, Thomas Paine was a stay-maker (like his father before him), sailor, school-master, tax collector, and tobacconist, before he emigrated to North America in 1774

There he arrived in the height of the controversy between Britain and the Colonies He at once threw himself heart and soul into the cause of the colonists, and helped them by serving for a time in their army, but very much more by his persuasive pen

"Freedom has been hunted round the globe Asia and Africa have long expelled her Europe regards her like a stranger, and England has given her warning to depart O, receive the fugitive and prepare in time an asylum for mankind!" This was his clarion call to the American colonists, published in January, 1776, in his pamphlet "Common Sense" Everybody of importance read it, and, as Washington said, it turned the scale of public opinion towards complete freedom from the Mother Country "Common Sense" and its successor, "The Crisis," a series of pamphlets which began with

the words, "These are the times that try men's souls," put new courage into the colonists when they were in their direst distress

After the close of the Revolution the Americans granted Paine money and land, which relieved him from the pinch of poverty

He returned to Europe in 1787 with a model of an iron bridge which he had invented, and which was exhibited in Paris and in London When the French Revolution broke out Paine became one of its English supporters He wrote an able book called "The Rights of Man," in reply to an attack on the Revolution published by Edmund Burke Today Paine's book seems very moderate, but for publishing it he was indicted for treason and fled to France There he was elected to a seat in the assembly called the Convention Though he was a Radical, Paine was not an extremist, and he opposed the execution of Louis XVI, proposing that, instead, he should be allowed to go to America This won him the ill-will of the Jacobins, and only Robespierre's fall saved him the guillotine

Paine's attack on President Washington, published soon after his release (1796), and his criticism of revealed religion in his "Age of Reason" lost him many of his old friends He returned to America in 1802, after the cause of liberty seemed lost in France, but only a few now remembered his services to the cause of the colonies He wandered from place to place until his death in New York City, June 8, 1809

BRUSH and PALETTE down the AGES

Here we are given a short history of the "queen of the arts" from the simple efforts of the cave-men down to the modern schools that the "man in the street" finds so difficult to understand

Painting. The history of painting begins in the remote ages when Man depended for his existence solely on his skill as a hunter Among



the men of the Old Stone Age, more than 20,000 years ago, there were painters who possessed the adroitness of hand and power of observation that enabled them to paint, with amazing fidelity and spirit, pictures of lions, horses, deer, and other animals which by any standards are recognized as being masterpieces of art

In the cave of Altamira in northern Spain we can still see their paintings of these animals, in three colours, executed with an assurance of line that would

do credit to the highly trained draughtsman of modern times

When Man had advanced a little farther in culture and learned to domesticate animals and raise crops, these naturalistic drawings disappeared Perhaps because they belonged to a different race, perhaps because they were no longer dependent entirely upon the skill of hand and of eye as hunters, the men of the New Stone Age seem to have lost their interest and adroitness in drawing Such rude attempts as we find representing men and animals in this period were immeasurably inferior to those of the Old Stone Age There seems to have been no re-development of the art of painting until the beginnings of the historic period, when men began to erect elaborate tombs and temples and decorate them with pictures

The paintings of the ancient Egyptians consisted simply of outlines filled in with flat colours They knew nothing about the rendering of depth or of light and shade They tended

PAINTING

to conventionalize the human form, drawing it with the shoulders in front view, the head in profile, and the eye full-face. This was also true of the archaic Greek method. Yet within their limits the Egyptians and Greeks achieved remarkable success. Men and animals were depicted in characteristic attitudes, often with touches of humour, and every phase of life was shown on the walls of their tombs. In many of their paintings the colours—yellow, red, brown, blue, and green, harmoniously combined with black and white—have remained vivid to this day. (See illustration in page 1415)

Decoration in Ancient Mesopotamia

While the art of painting was developing on these lines along the banks of the Nile, it also made considerable progress along the Tigris and Euphrates, where the Babylonians and Assyrians were learning to decorate the interior of their stucco-covered mud-brick walls with painted scenes, while they adorned the exterior with artistic glazed tiles. From the scanty fragments of their work that have survived, we can see that they were inferior to the Egyptians in their attempts to represent human figures, but far surpassed them in the vigour and spirit with which they represented animal figures.

In prehistoric Greece, Crete, and other Aegean lands, about 2000 years B.C., artists decorated vases in rich designs and painted the walls of palaces with animated scenes from the life of the time. (See Aegean Civilization.) The people who succeeded them, the Greeks of history, sweeping all this away, built up from rude beginnings a greater art of their own.

We can trace an ever-growing feeling for design in the black and red vases that have come down from this time, but their great paintings have disappeared. We can, however, form some idea of the genius which runs continuously through Greek into Roman times from the paintings on the buried walls of Herculaneum and Pompeii. (See Greek Art, Pompeii)

Paintings by the First Christians

Early Christian painting, though influenced by the art of the ancients, shows a decided change in subject and spirit. The followers of the new faith, persecuted by the Roman Empire, sought refuge and a place of worship in the great underground cemeteries known as the catacombs. They decorated the dark walls with religious symbols and with pictures of Christ and the saints, simply and crudely drawn. Later, when they were permitted to worship openly, they built churches and adorned their walls.

Often mosaics took the place of the mural or wall paintings, and many of these more permanent works of art still remain, while the paintings have been destroyed. (See Italian Art, Mosaic.) Wrought out of tiny bits of marble and glass, they represent the personages

who take their parts in the sacred narratives as figures of epic grandeur.

With the barbarian invasions and downfall of the Roman Empire in the West there was a general decline of the arts, including painting. Byzantine art, which reached maturity in the 6th century and flourished in the 10th and the 12th centuries, profoundly affected early Christian art, and gave an imported conventionalized splendour to the paintings and mosaics of Venice and other Italian cities. (See Byzantine Empire)

In the Middle Ages northern Europe was carrying on the traditions in its glorious illuminated manuscripts and in wall paintings (see English Art, Manuscripts, Illuminated), and by the 13th century painting in Italy and elsewhere in western Europe was taking on a new form, abandoning the stiff conventionalism of the Byzantine for a primitive realism which paved the way for the great period of the Renaissance.

Art Reaches Maturity in Italy

The story of painting from the 13th to the 15th century is, in fact, almost the story of the art in Italy. (See Italian Art.) The names of Giotto, Masaccio, Uccello, Leonardo da Vinci, Michelangelo, and Titian mark further stages as the great art developed. From its use as a means of showing the people scenes from the Bible and for emphasizing New Testament teachings, painting came to be more of a secular and purely pictorial art. Wall-paintings and "frescoes," in which the paint was applied while the plaster was still wet, were supplemented by easel pictures done in "tempera"—powdered pigments applied on a panel by mixing with yolk of egg or some similar medium.

Meanwhile, a strong and independent art had been developing in Holland and Flanders. Hubert and Jan Van Eyck headed the Flemish school of the 14th and early 15th centuries, and the latter of them is regarded as the inventor of oil painting. In the first half of the 16th century Germany could boast of two artists, Albrecht Dürer and Hans Holbein, who are among the great geniuses in the history of art.

Just as oil technique was taken to Italy from Flanders, so the next generation of Flemish painters studied in Italy and imported the Italian methods. Out of these "Italianizers" came the mighty Rubens, who, without losing his own individuality, brought into his work a good deal of the richness and fullness of Venetian art.

In the 17th century in Holland and Flanders there came a new democratic expression, when the Dutch "Little Masters," as they are sometimes called, raised the painting of common life to a great art. Their vision found beauty in the courts of kings, the sordid market-corner, the meadow or the farm-yard—wherever, indeed, the magical effects of light or colour were seen. It



ONE OF THE FIRST MEETINGS OF THE ROYAL ACADEMY

The first meetings of the Royal Academy founded in 1768, took place in some rooms in Pall Mall London. On January 2, 1769 the president, Sir Joshua Reynolds, gave the first of his famous discourses, during which he dealt chiefly with the value of academies and what he conceived to be the right direction in which to study art. This old print shows one of the first exhibitions held by the Academy.

Photo W. F. Taylor

was Rembrandt (1606-1669), the greatest of all the Dutch school, who first proved conclusively this principle of modern painting. He insisted that it was appearance that was important and not reality. He and the Spaniard, Velazquez (1599-1660), are accounted among the greatest of the world's painters who subordinated details to the impression of the whole. From Spain, too, came El Greco, the latest man to be hailed as the "world's most important painter" (See Spanish Art). Both Dutch and Flemish painting are described under the heading Netherlands Art.

Landscape painting became highly developed for the first time in the 17th century. Earlier artists had regarded landscape as incidental to the figure or the story of the picture, now it became the picture. The Dutch painters Ruysdael and Hobbema were followed in France by Claude Lorrain and there developed what is known as "classical landscape," in which very beautiful but more artificial effects were produced. (See French Art).

In the 18th century French painting reached tremendous heights, and Watteau in particular simplified the art for all posterity by the clever-

ness with which he evolved new ways of rendering light and shade, new "tricks of the trade" for simplifying the work of the artist and yet further deceiving the spectator. (See France Art). England, too, came to the fore, through Reynolds and Gainsborough as portraitists and, in landscape, through the brilliant work of Constable, who replaced the somber browns of the Dutch landscapists by the vivid tints of Nature. He and J. M. W. Turner (1775-1851), "the greatest magician of light who ever wielded a brush" (see Turner), bring us into the full swing of the 19th century.

The first new school was the Barbizon group, named from a village in the Forest of Fontainebleau, near Paris. (See France Art).

In England a few years later came the Pre-Raphaelite movement, which owed its inspiration largely to Ford Madox Brown, and included the youthful painters Rossetti, Holman Hunt, and Millais. (See Pre-Raphaelites).

But there was to come soon a new point of view in the expression of painting. In the early 1860's in France a group of painters were stirred to rebel against classic traditions, and strike out

along a new line. The name "Impressionists," which soon attached itself to this school, indicates their fundamental purpose, which is to paint the immediate impression the artist receives from objects in Nature.

The father of this school was Édouard Manet (1832-1883), and his chief followers were Claude Monet, Degas, Pissarro and Renoir. In England, the American, James McNeill Whistler, was the chief exponent of Impressionism, to be followed by Tonks, Sickert and Wilson Steer.

Aims of the Post-Impressionists

The Impressionist movement was followed by "Post-Impressionism," which represents a reaction against many of the traditional theories and practices of painting. The followers of this school no longer attempt to paint Nature, but seek to express feeling through form and colour.

As Roger Fry, one of the important English critics associated with the movement, says "The Post-Impressionists do not seek to paint form, but to create form, not to imitate life, but to find an equivalent for life. They wish to make images which, by the clearness of the logical structure and by their closely knit unity of texture, shall appeal to our disinterested and contemplative imagination with the same vividness that the things of actual life appeal to our practical activities."

Of the Post-Impressionists the most famous are the two Frenchmen Cézanne (1839-1906) and Gauguin (1848-1903), and the Dutchman, Van Gogh (1853-1890). It was Cézanne who said that all shapes could be reduced to cylinders, cubes, pyramids, and spheres, thus inspiring the Spaniard Picasso (born 1881), who formulated Cubism. Picasso, perhaps the most important influence in 20th-century painting, at least since the World War, studied abstract ideas with the intention not of imitating form but of creating it. In France, there was another group known as the "Fauves." They were led by Henri Matisse (b. 1869), who invented new qualities in the relation of colour and line.

These movements were followed by others, such as Vorticism, inspired by the Englishman Wyndham Lewis, Italian Futurism, Expressionism, a violent German art, and the many types of abstract painting, with which may be coupled Surrealism (*q.v.*) (See also articles on the world's chief painters, Impressionism and Post-Impressionism, Water-colour painting, etc.)

PAINTS AND VARNISHES Without paint, the grey battleship and the mighty bridge would rust and corrode in a short time, the strongest woodwork would decay and rot, and radiators and boilers would rust and leak.

Paint is a mixture containing a colouring matter, called a "pigment," suspended in a liquid in which it does not dissolve, called a "vehicle." There are two general classes: oil

paints, using an oil vehicle, and water-colours, made with water.

The vehicle of paint binds the pigments, linseed oil is generally used except in the newer quick-drying cellulose paints. The bodywork of motor-cars is now finished in cellulose, which is applied by spraying. Linseed oil is taken from the flax-seed by grinding, heating, and pressing, or is extracted by solvents. China-wood oil, called "tung" oil, is added in small quantities to hasten hardening.

To cut the cost, soya bean oil is sometimes used in place of part of the linseed oil, and the white lead is mixed with less expensive "fillers" or "extenders," such as silica, clay, gypsum, and barites. These fillers also modify pigments that are too light or bulky, and their coarse grain keeps the paint from excessive spreading, making fewer coats necessary.

How White Lead is Made

The white lead base for paints is produced by several processes. In the "quick" or "Carter" process granulated lead treated with acetic acid is put in slowly revolving drums and subjected to the action of purified carbonic acid gas. The chemical action that occurs is similar to that in the Dutch process. White lead is also made by electrolytic methods.

Metals, various earths, coal-tar products, and prepared bone give paints their colours. Lamp black, bone black, and graphite all make black. Cobalt, blue lead made in certain smelting operations, and Prussian blue, an iron derivative, produce blues. Chromate of lead and yellow ochre give yellows. Green comes chiefly from chrome green, or is made by mixing blues and yellows. Red oxides of iron and red lead give red pigments. Animal and vegetable pigments such as madder, indigo, and cochineal are too costly for building paints.

Usually several coats of paint are needed to provide a durable and even surface. The first or "priming" coat, or "primer" (from the Latin *primus*, meaning first), is a thin coat of white lead or red lead, and driers mixed with linseed oil and turpentine.

Oxide of iron and red lead, or graphite, mixed with linseed oil, make the best paints for external iron work. The former gives the familiar orange hue of iron work in course of construction. Zinc and aluminum powders are added to the pigments of the Navy's anti-corrosive paints. Both can be painted readily on iron and steel, and they tend to combine and protect the iron when corrosion occurs. Copper or mercury oxides added to spirit paints protect ships' bottoms from weeds and barnacles, the poisons dissolve slowly and destroy marine pests. Metallic paints, which include aluminum, copper, bronze, or gold powder, resist heat and are used for radiators, hot-water pipes, etc.

Asbestos, horax, powdered glass, or other retarders of fire are added to the usual formula to make fire proof paints Sulphides of barium, calcium, and strontium, which phosphoresce in the dark, make luminous paint High-grade luminous watch faces have paint containing a radioactive substance, such as mesothorium

The best grades of varnish are made from drying oils, such as linseed or tung oil, thinned with turpentine, and imported gums and resins However, small amounts of common rosin are

used in some good varnishes The fossil resins and rosins of varnish contain much acid and are melted to harden too much for use when mixed with basic white pigments This is overcome by the so called "ester gums," which combine acid resins with glycerol (See Gums, Varnish)

Stains are dyes which change the colour of woods, but leave the grain visible Porous woods must first be given a coat of "filler" to fill up all the pores The stain is often mixed with this filler

A JOURNEY through the HOLY LAND

A country where every stone and tree has a historic significance for the whole world—such is the holy land of Palestine, which to Jews and Gentiles alike is a place of pilgrimage

Palestine. On December 11, 1917, quietly and unostentatiously, without pomp or blare of trumpet, General Edmund Allenby, commander-in-chief of the Allied armies in the East, entered the city of Jerusalem and delivered Palestine from the age long tyranny of the Turks



Under their oppressive rule the people had suffered for centuries, and the once beautiful and fertile land had become barren and desolate For ages the hearts of half the world had turned with devo-

tion and longing towards this land of Canaan, which was the Promised Land of the Israelites and the birthplace of Christianity By Jew, Christian, and Mahomedan alike it is revered as the Holy Land

As you stand on the top of Mount Ebal—which, with Mount Gerizim opposite, guards the ancient city of Shechem (now Nablus)—and let your eye sweep over the landscape, you can view almost the whole of Palestine To the west you see the deep blue waters of the Mediterranean, bordered by gleaming sand hills, to the east the river Jordan and—far to the north, beyond the boundaries

of ancient Israel—snow-crowned Mount Hermon, while to the south you look upon Jerusalem on its height, and beyond to the southernmost hills of Judea skirting the wilderness

Leaving the Mediterranean port of Jaffa, the traveller passes through beautiful orange groves and then across the flat plains of Sharon Here in ancient times dwelt the Philistines (qv), from whom the entire country was named Palestine In some of the fields Arab farmers may be seen ploughing in much the same primitive fashion as in Biblical times, while on the hill sides shepherds clad in their long robes and turbans still watch their flocks as did the Israelites of old On many farms, however, ploughs and tractors of the latest design are used by the Jewish immigrants

Camels still plod along the roads to Jerusalem, but motor cars are becoming commoner every year Even the Holy City has changed, especially in the suburbs, though it is the ancient sacred places that constitute the principal attraction for tourists (See Jerusalem)

From the Holy City a winding and precipitous road leads to Jericho, which lies nearly a quarter of a mile below the level of the sea Jericho was the first city which the Israelites conquered when they entered the Promised Land, many centuries before the birth of Christ, and it was already a city noted for its wealth and luxury It was rebuilt by the Romans and made so splendid that Antony chose it as a gift to

Extent—North to south, 265 miles, east to west, from less than 10 to about 80 miles Total area (not including Transjordan) about 10,000 square miles, population, about 1,175,000 (\$48,000 Mahomedans, 370,000 Jews, 100,000 Christians)

Physical Features—From the coastal plain along the Mediterranean the land rises towards the east, forming a rugged plateau intersected by deep valleys and broken mountain ranges, highest point, Jebel Jermak (5,934 feet) in Galilee At the east the plateau drops steeply into the depression down which the river Jordan rising on Mt. Hermon (9,400 feet) beyond the northern boundary, flows south through the Sea of Galilee to the Dead Sea (1,300 feet below sea-level)

Products—Oranges, grapes, olives and olive oil, wine, soap, nuts, wheat, barley, durra, sesame, tobacco, water-melons, sheep, goats, camels, hides and skins, wool, salt cement

Chief Cities—Tel-Aviv (140,000), Jerusalem (capital, 125,000), Haifa (99,000), Jaffa (71,000), Hebron, Nablus, Gaza (all over 15,000), Lydda, Ramleh, Safed, Tiberias, Nazareth, Acre, Bethlehem, Jericho



ON THE BANKS OF THE SACRED RIVER JORDAN

This is the stream in which Christ was baptized by John the Baptist. Today guides conduct travellers through this region. The reach shown above is near the Dead Sea, into which the Jordan flows. The river occupies the northern part of one of the most celebrated "rift valleys" in the world.

present to his beloved Cleopatra. Now only a small modern settlement marks the site of that famous "city of palms." Even its natural beauty has suffered, for the palm trees have almost entirely disappeared.

A few miles farther and we are at the banks of the river Jordan, which we find thronged with Christian pilgrims who have come to bathe in the muddy turbulent waters of this historic stream. Each sect has a different bathing-place, which each claims to be the exact spot where Jesus was baptized by John the Baptist. Tamar trees, willows, poplars, and various shrubs clothe the banks here, but as we follow the swift stream southward to the Dead Sea the vegetation takes on a sickly look.

Occupying the lowest part of that great chasm through which the Jordan flows, the Dead Sea (qv) is almost 1,300 feet below the surface of the Mediterranean.

The Dead Sea deserves its name, for it contains no animal life except of the lowest, and fish put

into its water soon die. Yet this shroud of desolation promises to become a valuable source of revenue, for it contains large amounts of potash and other salts, which are being extracted by evaporation. The river Jordan is also being made to serve an economic purpose, for it is being harnessed to supply several cities with electricity.

Climbing back over the barren hills of Judea, we reach Bethlehem (qv), where Jesus was born. A few miles farther south, in the ancient city of Hebron, is the cave where Abraham, Isaac, and Jacob are supposed to be buried. About this place has been built a Moslem mosque, for the Mahomedans regard these patriarchs with immense reverence.

Passing to the north, we cross Samaria and reach the fertile, well-watered, and pleasant land of Galilee. Here, nesting among the hills, we find the town of Nazareth (qv), where Jesus spent His boyhood.

Not far away to the east and north are the calm blue waters of the Sea of Galilee (Lake of



A SAMARITAN READING THE LAW

Only a few families remain in Palestine today to represent the ancient Samaritan people. They recognize only the Pentateuch (the first five books of the Bible) as sacred, and claim that the orthodox Jews have departed from the pure Mosaic teachings.

PALESTINE

Gennesareth or Tiberias) On these shores Jesus often walked, and here He met the fishermen who became His apostles. Now the region is quieter than it was in His day. Only a few scattered boats are seen on the waters, which were once covered with sails. With the exception of Tiberias, which has been rebuilt, the ring of cities whose stately buildings were reflected in its waters have fallen leaving only heaps of ruins. But the lake has not lost its beauty. Its waters drain southward through the Jordan into the Dead Sea.

Ascending one of the hills of Galilee and looking eastward, we see across the Jordan the heights of Gilead with their forests of oak and terebinth or Chan turpentine trees.

To the south is the famous Plain of Esdraelon, the vast arena in which so many battles have taken place. Armies from the great empires of the Nile and of the Euphrates, from the north and the south, from the east and the west, have here met in deadly conflict. In the early days of Israel's history Barak and Gideon won here their splendid victories, and here Saul met defeat against the Philistines, and Josiah against the Egyptians. Across this plain Jehu came driving so furiously to Jezreel, here the valiant Maccabees won freedom for the Jewish people, and in the Middle Ages many a Crusader died in the Plain of Esdraelon fighting for the Cross.

Napoleon's advance from Egypt was here checked by the Turks and British, and after three months' fighting he was forced back in the first great retreat of his career. In the World War of 1914-18 the Allies won Palestine from the Turks in this field that is supposed to be the Plain of Armageddon to which the Book of Revelation refers as the place where "the kings of the earth and of the whole world" are to gather for "the battle of the great Day of God Almighty" the Day of Judgement.

Today, however, the Plain of Esdraelon is a scene of peace and beauty, the home of prosperous Jewish agricultural colonies. This naturally fertile region, which through generations of neglect had become a land of pestilential swamps

and barren wastes known as "the Valley of Death," has been reclaimed through the labour and sacrifice of Jewish pioneers.

In material things Palestine is a poor country. Its natural resources are few. It has few minerals—no coal, no iron, no copper, no silver. Its forests have almost disappeared. Only in a few isolated spots is the land productive. The ancient Israelites, coming to it from the wilderness called it "a land flowing with milk and honey", but it was only through patient toil that they won an abundance for their needs, and after many centuries of neglect much of the country has become a waste.

Even in Palestine's palmiest days water was so scanty as to be considered extremely precious. All through the Bible we find praise of water—of brooks and springs and wells. Rainfall was probably more abundant than today because



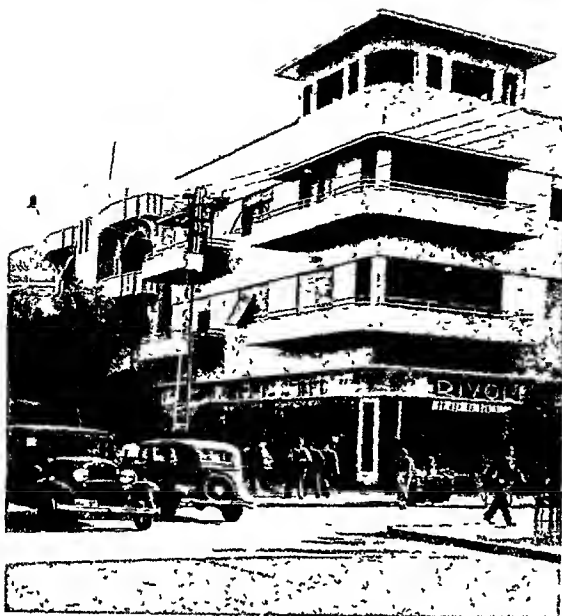
PADDLING IN THE SEA OF GALILEE

Drawn by McLeish

Formed by an expansion of the river Jordan, the Sea of Galilee is 13 miles long and 8 miles wide. As we can learn from the Gospels, this sea or lake—it is known also as the Lake of Tiberias or Gennesareth—is subject to fierce and sudden storms though in this picture it is in placid mood. Around its shores lie the remnants of ancient cities such as Capernaum.

of the greater number of trees, but seasons of drought often occurred even in those times. The rainfall is not evenly distributed throughout the year in Palestine. Practically all of it falls during the winter months, beginning in October or November with the "early" or "former rain," and ending with the heavy showers of March and April, called in the Bible the "latter rain." Much of the rain, too, percolates through the limestone rock and is thus wasted. The great forests, which in ancient times helped to conserve the moisture, have almost disappeared, but large areas are now being reafforested.

Remarkable improvements have been made recently, especially in transportation. During



MODERN ARCHITECTURE IN PALESTINE

Where once was a waste of sand-dunes now stands the growing modern city of Tel-Aviv. The Jewish architects have in many cases made striking departures from the conventional idea of a Palestinian city, as can be seen from this photograph taken at the junction of Allenby and Montefiore streets.

Photo American Colony Jerusalem

the World War the British built a double-track railway from Port Said to Haifa, which has superseded Jaffa as the chief seaport and has a magnificent new harbour completed in 1933. This links up with the Turkish line to Istanbul, so that it is now possible to go by rail from Cairo to Istanbul. Other railways and excellent roads for motorizing link all the chief towns.

Of the population of Palestine about three-fifths are Arabs (Mahomedans in faith), including many wandering shepherds. Jews form the greater part of the remainder.

In the settlement which followed the World War, Palestine was taken from the Turkish Empire, and all the country west of the river Jordan was given to Great Britain under a mandate from the League of Nations. Great Britain had already given a pledge (the famous Balfour Declaration) to do everything it could to aid the realization of the Zionists' dream of

"establishing in Palestine a national home for the Jewish people."

Much has been done towards the realization of this dream. Not only has agriculture been developed, but a number of industries, of which there were practically none before the World War, have been established. A striking instance of the progress due to Zionist activity is seen in the Jewish city of Tel-Aviv. Established in 1909 as a suburb of Jaffa and built on what was only a waste of sand-dunes, it has grown into a city of about 140,000 persons.

Hand in hand with the economic development has gone a revival of learning, and a centre of Jewish culture and research has been established in the Hebrew University at Jerusalem.

But there remain many obstacles to be overcome and many difficult problems to be solved. Many of the Arabs fiercely resent the establishment of a Jewish home land in the country they have occupied so long, and at times this resentment has found expression in violence.

A serious outbreak occurred in 1929, when a dispute arose over the rights of the Jews at the Wailing Wall in Jerusalem which stands on Arab ground. Arab demands in 1935 for the cessation of Jewish immigration (which had been increasing rapidly) were

followed in 1936 by riots involving considerable loss of life. British troops were sent to quell the disturbances, and in July, 1936, a Royal Commission of Inquiry was appointed.

In July, 1937, the Commission, of which Lord Peel was chairman, published its findings. Its main recommendations provided for the division of the country into a sovereign Arab state, a sovereign Jewish state, and a territory ruled by Great Britain under a permanent mandate—the last to include the Holy cities of Jerusalem, Bethlehem, and Nazareth, with a corridor from Jerusalem to the sea. The Arab state would cover about two-thirds and the Jewish state about one-third of Palestine. (See also Jews)

Palm. The silhouette of a palm tree, with its tall, slender, unbranching trunk surmounted by a wonderful crown of enormous leaves, is a sight which one could never forget or fail to recognize at first glance. The trunk mounts



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IN THE TOWN OF CHRIST'S NATIVITY

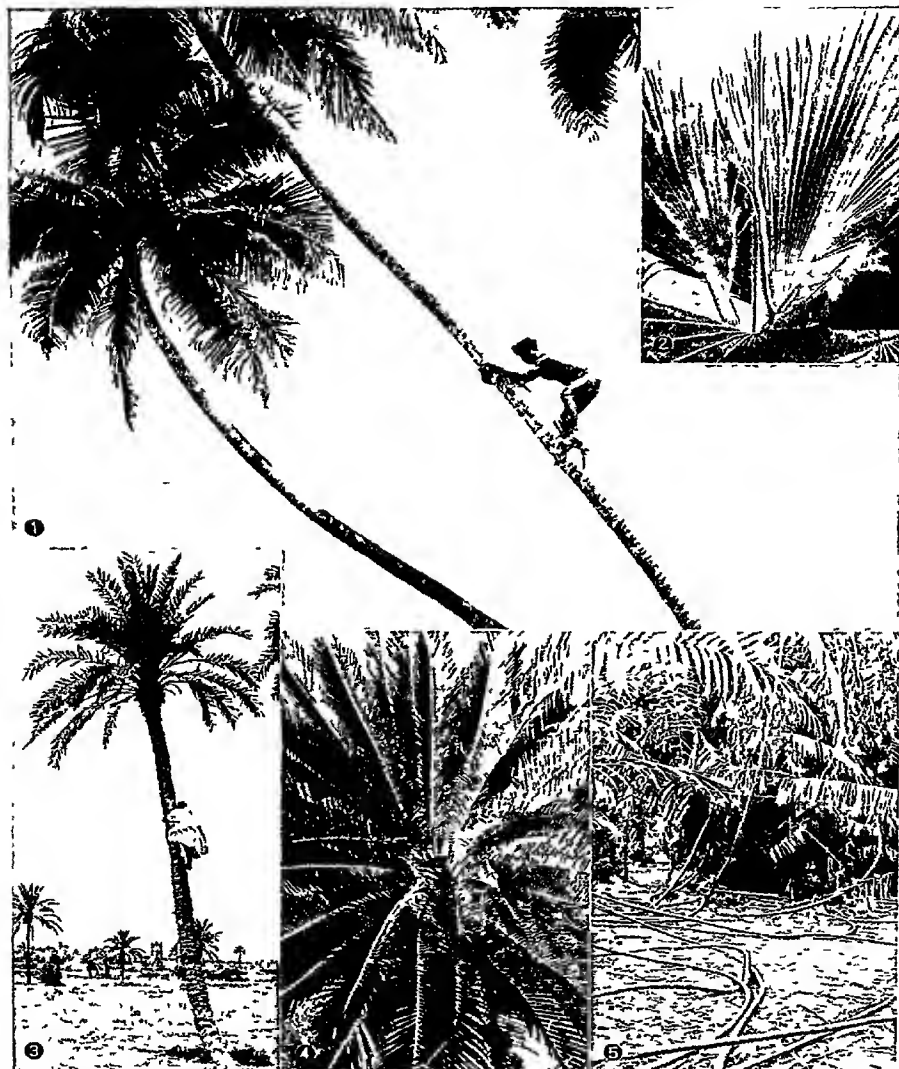
This photograph of an old Arab astride his sturdy ass was taken in Bethlehem the little Palestinian town where Jesus Christ was born nineteen hundred years ago. There is nothing in the picture which would have been out of place in those far-off days for Bethlehem until quite recently, has always been set in a quiet backwater of peace.



CARRYING WATER IN PALESTINE

In Bethlehem, the birthplace of Jesus and of King David, young women carry jars of water balanced upon their heads, as is the custom among many Eastern races. The head-shawl and gown of this girl are embellished with coloured embroidery which she has no doubt worked with her own skilful fingers.

USEFUL VARIETIES OF PALM FROM MANY LANDS



1. A native of Ceylon scaling the long, slender, leaning trunk of a Coconut Palm. This palm thrives on tropical coasts and islands throughout the world. 2. One of the many Fan Palms from which fans and roof thatching are made. 3. An Arab gathering a meal of datoo from a Date Palm in Algeria. 4. Looking down into the heart of a young Sago Palm. The pith of these palms is made into the sago of commerce. 5. These ropelike stems are Rattan Palms on the island of Java. They run over other trees or along the ground and may grow several hundred feet long. Strips from the stems are woven into ropes, mats, and furniture.

straight into the air, often for 100 feet or more, suddenly bursting at the top into a rosette of leaves radiating from it like the outspread fingers of the hand. It is this resemblance that gives the palm its name, from the Latin word *palm*, meaning "palm of the hand."

Some palms, like the familiar potted palms in our houses, are mere shrubs. The dwarf palmettos have buried stems and form low scrubby growths, covering the ground like weeds, making, with their large prickly leaves, a well-nigh impenetrable thicket. Others, such as the iatan palms, have long slender rope-like stems which climb like vines and often are several hundred feet long, their leaves appearing at intervals along the stems.

More than 1,200 species of palms have been described. They are found mostly in the Pacific islands, in Asia, America, and Africa. Though they reach their greatest development in the rainy tropics, some species, such as the date palm (which is believed to be the palm of the Bible), grow in very arid regions, and others in the temperate zone.

Palm leaves are of two main types: *fan-shaped* (palmetto), as in the common fan palm and palmetto, and *feather-shaped* (pinnate), as in the date and the coconut palms. In some species the leaves are 30 to 45 feet long and 4 to 8 feet wide. The flowers are small and usually white, greenish, or yellow in colour, they are borne in clusters in the crown of leaves.

Next to the cereals and other members of the grass family, the palms are the most useful of all plants. Their fruits, stems, and leaves are used in a great number of manufactured products, besides furnishing food, shelter, and clothing for the natives of the regions in which they abound. (See Coconut Palm, Date Palm.)

Among important palm products may be mentioned dates, a staple food of many desert peoples, palm-oil, derived from the fruits of the oil-palm (*Elaeis guineensis*) and other species, used for food and cattle fodder, in soap-making, and as a lubricant, palm-wine, from the sap of several species, sago and starch, from the pith of the sago palm (*Metorylon*) and other varieties, rattan, the thin flexible stems of various species of *Calamus*, and vegetable ivory, the nuts of the tagua or ivory palm (*Phytelephas macrocarpa*), from which huttons and many

other small articles are manufactured. Many valuable fibres used in making brushes, hats, and baskets are derived from palms. Some of the commonest kinds are raffia, piassava, kitoor, African fibre, palmetto, and oar or coconut fibre. Palms are the largest of all the Monocotyledons, and belong to the family of *Palmaceae*.

Palmerston, HENRY JOHN TEMPLE, 3RD VISCOUNT (1784-1865). This British statesman, a typical sporting nobleman of the old school, was a Minister of the Crown for over 50 years. Most of his 80th birthday he spent in the saddle, and he died within four days of his 81st birthday with his official dispatch-box and an unfinished letter by his side. He will always be remembered as a forcible and aggressive champion of the rights and security of Britain, and as a supporter of the oppressed.

His independent attitude often got him into trouble. In 1850 he was rebuked by Queen Victoria for failing to obtain the royal sanction for his measures, and in 1851 dismissed from office for expressing an opinion to the French Ambassador on Louis Napoleon's *coup d'état* without the approval of his colleagues.

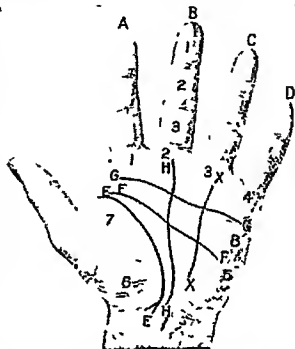
Palmerston was Secretary for War from 1809 to 1828, and Foreign Minister from 1830 to 1841 and from 1846 to 1851. After a period at the Home Office public dissatisfaction with the conduct of the Crimean War led to the appointment of the veteran statesman as Prime Minister, from 1855 to 1858, and again from 1859 until his death, when his reputation stood far higher than in his earlier days.

Palmistry. Look closely at the palm of your hand. You will find a series of lines crossing the flesh, and if you compare these with the lines on a friend's

hand, you will probably find that they are quite different in length, direction, or definition.

The men and women who practise the serious study of the hand are known as palmists, so called fortune-tellers and astrologers who earn a livelihood "reading" hands with the aid of a horoscope (an observation of the position of the stars at the hour of a person's birth, by means of which an astrologer professes to be able to foretell that person's future) are often palmists of doubtful scientific knowledge.

There are three principal lines on the hand recognized by palmists: the line of life, running right round the base of the thumb, the line



READING THE PALM

This diagram of the left hand shows the principal lines and parts dealt with in palmistry. Fingers: A, Jupiter, B, Saturn, C, Apollo, D, Mercury, three phalanges shown numbered. On the hand, 1, 2, 3, and 4 are "mounts" of Jupiter, Saturn, Apollo, and Mercury respectively, 5, mount of Luna, 6, mount of Venus, 7, mount of Mars. Principal lines: E, Life, F, Heart, G, Head, H, Fate, I, Jupiter, J, Saturn, K, Mercury, L, Jupiter, M, Saturn, N, Mercury, O, Jupiter, P, Saturn, Q, Mercury, R, Jupiter, S, Saturn, T, Mercury, U, Jupiter, V, Saturn, W, Mercury, X, Jupiter, Y, Saturn, Z, Mercury.

of the head, running diagonally across the palm and meeting the line of life above the thumb, and the line of the heart, nearer the fingers and sometimes running up to the root of the index finger. The different parts of the hand are named after the planets, the thumb belonging to Venus, the first (index) finger to Jupiter, and so on. The fleshy pads at the base of the fingers are called "mounts."

The smaller markings on the hand are noted equally carefully by the experienced palmist, who endeavours to find a meaning for all of them. Character and future events are the principal subjects of his readings, and occasionally the forecasts do prove accurate.

Palmyra, SYRIA
It is five days' camel journey from Damascus across the Syrian desert to the ruins of Palmyra, the beautiful city from which Queen Zenobia 16 centuries ago held sway over a considerable kingdom on the eastern border of the Roman Empire, from northern Palestine to the Euphrates.

The famous "city of palms" can never have been more than a square mile in area, but the whole of that space was made beautiful. Through the centre, for nearly a mile, extended a great quadruple colonnade of rosy white limestone, 750 columns in all, each of them 55 feet high, and terminating in a triumphal arch. Beyond this, upon a terrace, stood the Temple of the Sun, its court surrounded by pillars intricately carved.

The wealth which made this beauty possible began to pour into Palmyra before the Christian era, when the oasis in which the city stood became a trade post on the camel route by which the silks, perfumes, and jewels of the East were brought to the Mediterranean world. The city's most splendid period extended from A.D. 130 to 270, when political importance was added to wealth by Rome's recognition of Palmyra as a valuable buffer state against the rising empire of Persia. Zenobia's husband, Odenathus, was made viceroy of the East, in

return for military operations against Persia. His glory was short lived, for he was assassinated in 207, at the height of his success.

After her husband's death Zenobia sought an independent empire for her son, but the story of her splendid defiance of Rome—which you may read in Chaucer's "Monk's Tale"—had a tragic ending. Her armies were no match for the troops of the vigorous soldier-emperor Aurelian, whose desert march to Palmyra was an achievement worthy of a Roman, and in 273 the queen was conquered and graced the emperor's triumph. The city was destroyed, and thereafter the caravans took other routes.

Palmyra today is inhabited only by a few Arabs, whose mud huts are built in the courtyard of the Temple of the Sun. Vast ruins, however, remain. Palmyra is the Tadmor of the Bible (2 Chron. viii, 4), which is said to have been built by Solomon.

Pan. In Greek mythology there is, perhaps, no more picturesque figure than Pan, the god of flocks and pastures, of fields and forests. He is represented as having horns, a goat's beard, pointed ears, a tail, and goat's feet.

He led a merry life, dwelling in caves, wandering through wood and dale and over the mountains, protecting flocks, hunting and fishing, and dancing with the nymphs. He fell in love with the beautiful nymph Syrinx, the legend relates,

but, frightened at his appearance, she fled from him, and was transformed into a reed. From this reed the god made the instrument known as the syrinx or Pan's pipes. (See illus. p. 2859).

The mischievous Pan took delight in coming upon travellers unexpectedly and exciting the sudden fear which has come to be called "panic." He is often represented as accompanied by rogues, goat-like beings much like himself, called satyrs. These were the fauns of Roman mythology, the companions of Faunus, who occupied a position similar to that of Pan. The worship of Pan was introduced into Athens from Arcadia about the time of the Persian wars,



PALMYRA, CITY OF PALMS

Though the once fair city of Palmyra has long since fallen into decay, splendid ruins still testify to its former greatness. Among the many temples which adorned it the greatest was that of the Sun, the base of one of whose walls is seen here.

Photo American Colony Jerusalem

because of his supposed aid to the Athenians in the battle of Marathon

In later times Pan came to be regarded as the god of universal Nature, through confusion of his name with a Greek word meaning "all," and finally came to stand for all the Greek gods, and for paganism itself. So a legend arose that when Christ was born a mighty voice proclaimed "Pan is dead," thus heralding the end of the power of the old divinities

Panama, REPUBLIC OF This little Central American republic arose by a bloodless revolution in November, 1903. The province of Panama had long been a part of the Republic of Colombia, which occupies the north-west corner of South America. But relations had often been strained, and when the Colombian Senate refused to ratify a treaty confirming the transfer to the United States of the rights of the French Canal Company, the people of Panama declared their independence (November 3, 1903). Ten days later President Theodore Roosevelt formally recognized the new republic, and on November 18 concluded with Panama the treaty authorizing the transfer of the French rights and leasing the Canal Zone to the United States.

The republic occupies most of the isthmus which joins the continents of North and South America, and is washed by the Caribbean Sea on the north and the Pacific Ocean on the south. It has an area of 32,380 square miles, and although its land boundaries are only 480 miles

long, its coast-line totals 1,245 miles. It is cut in two by the Canal Zone, a strip of land five miles on each side of the canal, over which the United States exercises jurisdiction.

This region has been transformed from one of the most insubstantial and backward to one of the most healthy and progressive of tropical countries. The soil is naturally rich and the climate varied by the mountains, making it possible to raise a great variety of crops in a small area. In the lowlands on the coast coconuts and bananas are grown. At the back of this region is excellent sugar land, and still farther back fibre plants and rubber trees thrive.

In the higher altitudes tobacco, cacao, and coffee are raised, while the mountain sides and high plateaux are suitable for vegetables of the temperate regions. Bananas, hides, rubber, coconuts, and native curios are the chief exports. The country gives its name to the Panama hat.

Panama contains the oldest settlement on the mainland. It was visited by Columbus in 1503, and was a colony of Spain until 1821, when it proclaimed its independence and joined Colombia, of which it remained a part until the revolution of 1903. A treaty signed in 1936 gave Panama the new status of a sovereign ally of the United States. The chief cities are Panama, the capital, with a population of over 74,000, and Colon, with a population of about 29,000. The population of Panama (excluding Canal Zone) is about 467,500, that of the Canal Zone, 30,000.

How MAN beat NATURE at PANAMA

A waterway only fifty miles long and, at most, a thousand feet wide would not seem of great importance, yet the Panama Canal is both a marvel of engineering and one of the world's greatest highways of trade

Panama Canal.

Perhaps the most stupendous piece of work that has been done in America since the coming of Columbus was the building of the Panama Canal, and of all the stories in the world there are few more enthralling than this.

One chapter in this tale of adventure tells of Man's struggle against two deadly enemies—the *Anopheles* mosquito, which carries the parasite that causes malaria, and the *Stegomyia* mosquito (now called *Aedes*), the carrier of yellow fever. For thousands of years these insects had helped to keep two oceans apart, but at last scientists and engineers

CHIEF FACTS CONCERNING THE CANAL

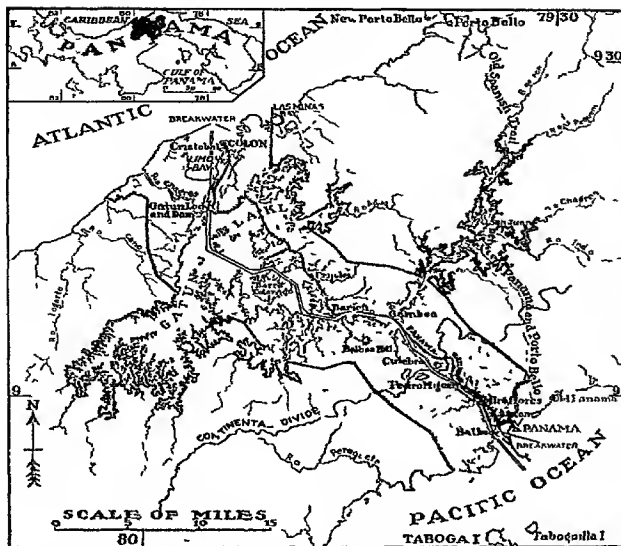
Work begun, May 4, 1904; canal opened, Aug. 15, 1914
Total length of canal, 50.7 miles; bottom width of channel, 300 to 1,000 feet
Number of locks, 12; length of each 1,000 feet, width 110 feet
Height of Miraflores Lake, 55 feet above sea-level, of Gatun Lake, 85 feet above sea-level
Amount of earth and rock excavated before opening of the canal, 239,000,000 cubic yards. Total cost of the canal, including payments to Panama, the French Company, and for sanitation, \$75,000,000
Time required for a vessel to pass through the canal, 6 to 8 hours
Distances saved: Liverpool to San Francisco, 5,666 miles; Liverpool to Vancouver, 6,000 miles; New York to San Francisco, 7,873 miles, and to Yokohama, 3,768 miles

defeated them, and linked the Pacific with the Atlantic by means of a canal. Now giant steamships climb a water stairway over the intervening mountains. New York is nearer Australia by 3,000 miles, and the journey from Liverpool to Vancouver is 6,000 miles shorter.

The narrow Isthmus of Panama, only about 40 miles wide, has

been famous in history since the days when Balboa and Francis Drake first made their separate ways through its tropical forests and looked out on the Pacific Ocean. Old Panama on the Pacific side became one of the key-points of the world, and across the isthmus

PANAMA CANAL



WHERE THE ATLANTIC IS WEST OF THE PACIFIC

Doesn't this map seem puzzling when you first look at it? There's the Atlantic to the west where the Pacific ought to be. Yet it is perfectly accurate. The Isthmus of Panama, as you can see on the little map in the upper left-hand corner, takes a dip to the south-west at this point. This makes the Atlantic end of the canal actually further west than the Pacific end. The heavy lines indicate the boundaries of the Canal Zone.

ran the road to Porto Bello, over which the treasure hunters of Spain carried their silver and gold to avoid the voyage by way of Cape Horn.

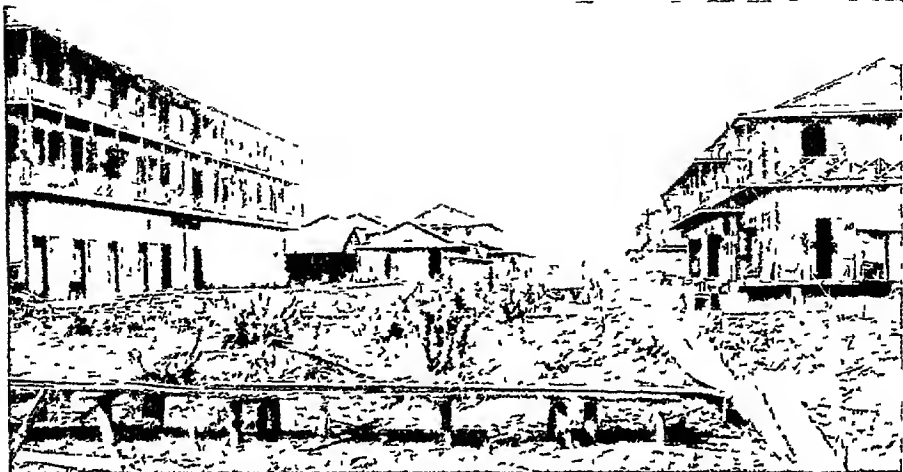
Until a few years ago, the true lords of this historic region were not the kings of Spain or the seekers of gold, or yet the buccaneers who scattered desolation everywhere on the bordering seas. The kings of Panama were *Stegomyia* and *Anopheles*, who had no thrones of gold, but held the power of life or death over every man and woman and child on the isthmus. They took no taxes, made no laws, raised no armies—and commanded no respect. No traveller or subject bowed down to them. Yet in their power lay the destinies of this beautiful land, without a single word, without a single sword, they drove back mighty hosts and broke the power of nations. When a band of hardy Scotsmen, at the end of the 16th century, founded a settlement on the Gulf of Darien, it was the forces of *Stegomyia* and *Anopheles* even more than the Spaniards who laid siege to their camp and put them to rout. And when, two hundred years later, Europe sent out its engineers to dig the Panama Canal, these insect kings were reigning

still, and today tons and tons of rusted steel, and crumpled up engines, and hars of iron that trees have picked up and twisted around their branches tell the tale of how the mosquitoes dealt with those agents of civilization.

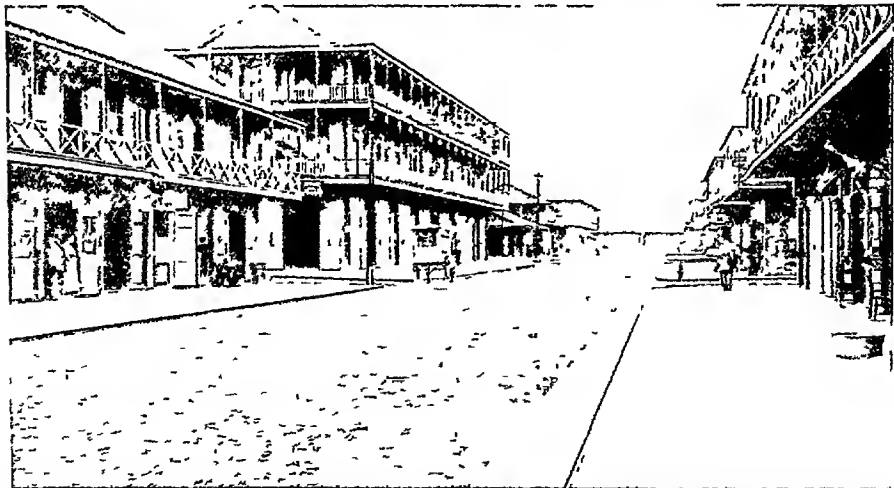
For generation after generation they consumed the lifeblood of the people who lived in this strategic region. The heat of Panama is such as only tropical travellers know, the rainfall is terrific, and so, in a country with unmade roads, with only the roughest tracks beaten by the tramping feet of centuries of passer-by, there was stagnant water everywhere. Moisture and warmth and a rich soil gave rise to luxuriant forests, tangled jungles of vegetation in which insects lived in countless myriads, and into the still lakes and pools and marshes poured a rushing stream of decay, of dead and dying animal and vegetable matter year after year, until it seemed natural that a city of 10,000 people, like Colon, should have 150,000 graves. And so Panama came to be unfit to live in.

The great French engineer Ferdinand de Lesseps who had already dug the Suez Canal, set out in 1881, as head of a French company and with a concession from the Republic of Colombia, to cut the American continents apart at the narrow Isthmus of Panama. There was a French consul there who advanced an engineer the money for a suit of clothes one day, and invited him to lunch the next, but the engineer did not come. He had died of yellow fever at three o'clock in the morning, and was buried at dawn in the new suit he had just put on. There was another Frenchman, the first director-general of the canal, who spent £30,000 in building a house on the top of a hill, but before the house was finished his wife and son and daughter had died of yellow fever, and the director-general went back to France alone, a broken-hearted man. Another man took his place, he died of yellow fever. A thousand men were sent to dig, and every man was dead within a year—from yellow fever. Another thousand took their place, and before the first year ended the second thousand were dead, too. Sixty-nine men in every hundred died at times,

CLEANSING A CITY IN THE PANAMA CANAL ZONE



One of the first tasks of the American engineers was to clean up the towns. These two photographs show the same section of Tooth Street, Colon, before and after paving. Paving the streets not only made traffic easy, but it gave the city a new appearance and made the residents eager to keep clean.



Gorgas, the American army doctor, commanded the fight for health. He drained every ditch and pond that could be drained and over those that could not he spread a film of oil which killed the mosquito larvae. He destroyed all vermin, burned all rubbish, screened windows, doors and porches, screened every train, and on every train put a hospital car. From one of the most unhealthy spots in the world, the Isthmus of Panama became one of the most healthy. During the ten years of American work on the canal, there were only 563 deaths, making the death rate 1.7 per cent, which is lower than in the large American cities. The death rate during the ill-fated attempt of De Lesseps to build the canal was 7,500 a year!

PANAMA CANAL

ten thousand after ten thousand brave workmen were stricken and fell. So death went about in Panama, and nothing could stop its march.

With 40,000 men and more than £50,000,000 spent, the great De Lesseps failed. His company went bankrupt, and a number of French public men were ruined in reputation by scandals connected with the "Panama Affair." De Lesseps died with a broken heart in Paris in 1894. His name is immortalized by his canal at Suez, but it is written across Panama in heaps of rusty iron and ruined machinery. There it lies in swamps and jungles, proclaiming to all the world the failure of human power against an invisible foe.

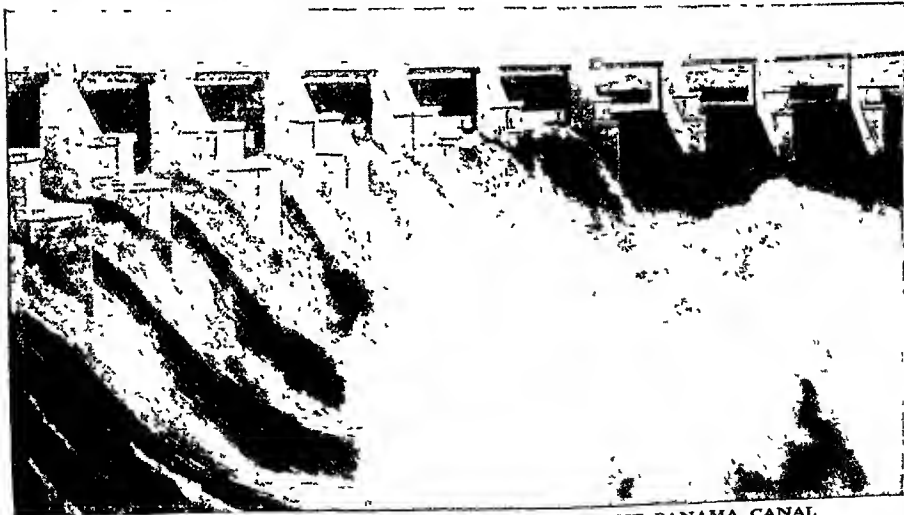
French Chemist to the Rescue

But if De Lesseps failed in the work at Panama, another Frenchman who stayed at home led the way to the discoveries in science which later enabled the task to be carried through to victory.

It was Louis Pasteur (*qv*) who, looking through his microscope, first set men searching for the invisible agents of death at Panama, and thus led to the conviction of *Stegomyia* and *Anopheles* on the charge of destroying hundreds of thousands of lives.

What Pasteur found was this: Man has against him in his march of conquest myriads of smaller creatures which, often before he knows it, poison him and may destroy him. Sometimes these creatures live on a man's body, so that we call them parasites, because they live on others; sometimes they have smaller parasites which live on them, so that even a harmless insect may carry a poisonous parasite and give it to a man with its sting. This discovery by Pasteur would perhaps have saved the lives of all those Frenchmen who died in digging the canal. In addition to the work of the great Pasteur himself, credit is due to his countryman, Dr. Charles Laveran, who in 1880 first discovered the parasites which produce malaria, to the Englishmen, Sir Patrick Manson and Sir Ronald Ross, to the Italian zoologist Grassi, and to Dr. Walter Reed in the United States, who took the final step in this great work. So this knowledge—that malaria and yellow fever are mosquito-borne diseases, and that they could be conquered only by the elimination of the mosquitoes—came into the world.

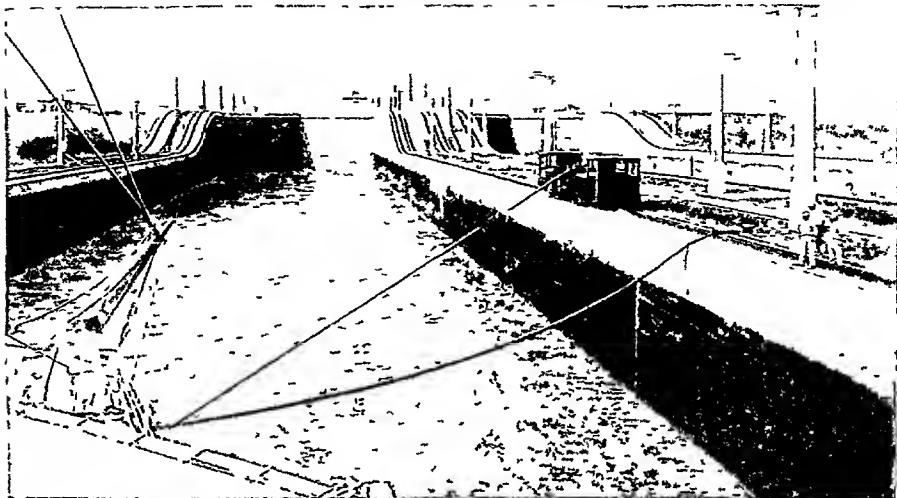
For 70 years the United States had taken an interest in various projects for an isthmian canal to link the Pacific with the Atlantic.



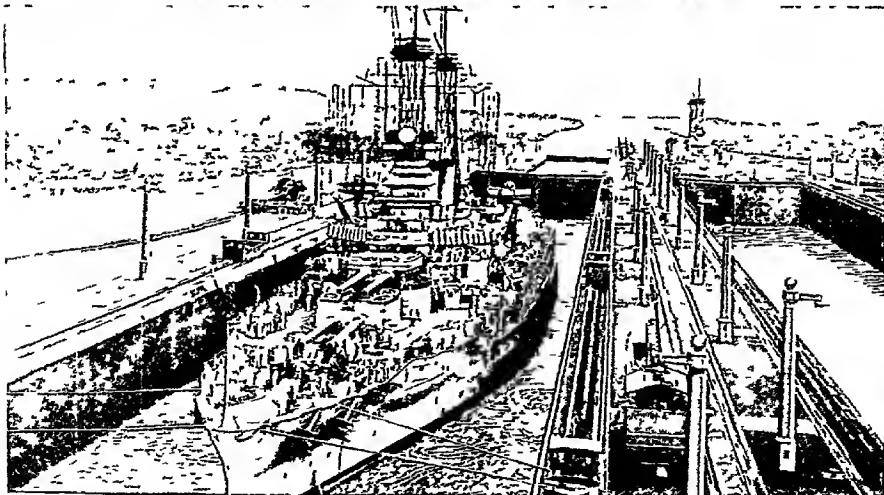
OPENING THE SPILLWAY AT GATUN DAM ON THE PANAMA CANAL

At the time of its construction, this was the largest dam in the world. It is nearly $1\frac{1}{2}$ miles long measured at the crest, and half a mile thick at the base. At the surface of the water the dam is 400 feet thick. Twenty million cubic yards of material were required to build the dam. The concrete spillway shown in the photograph is 1,200 feet long and 300 feet wide, cut through a hill of rock in the centre of the dam. It required 225,000 cubic yards of concrete to build the spillway alone. This spillway allows the surplus water from Gatun Lake to empty out through the Chagres River.

THE GATUN LOCKS LET A BATTLESHIP THROUGH

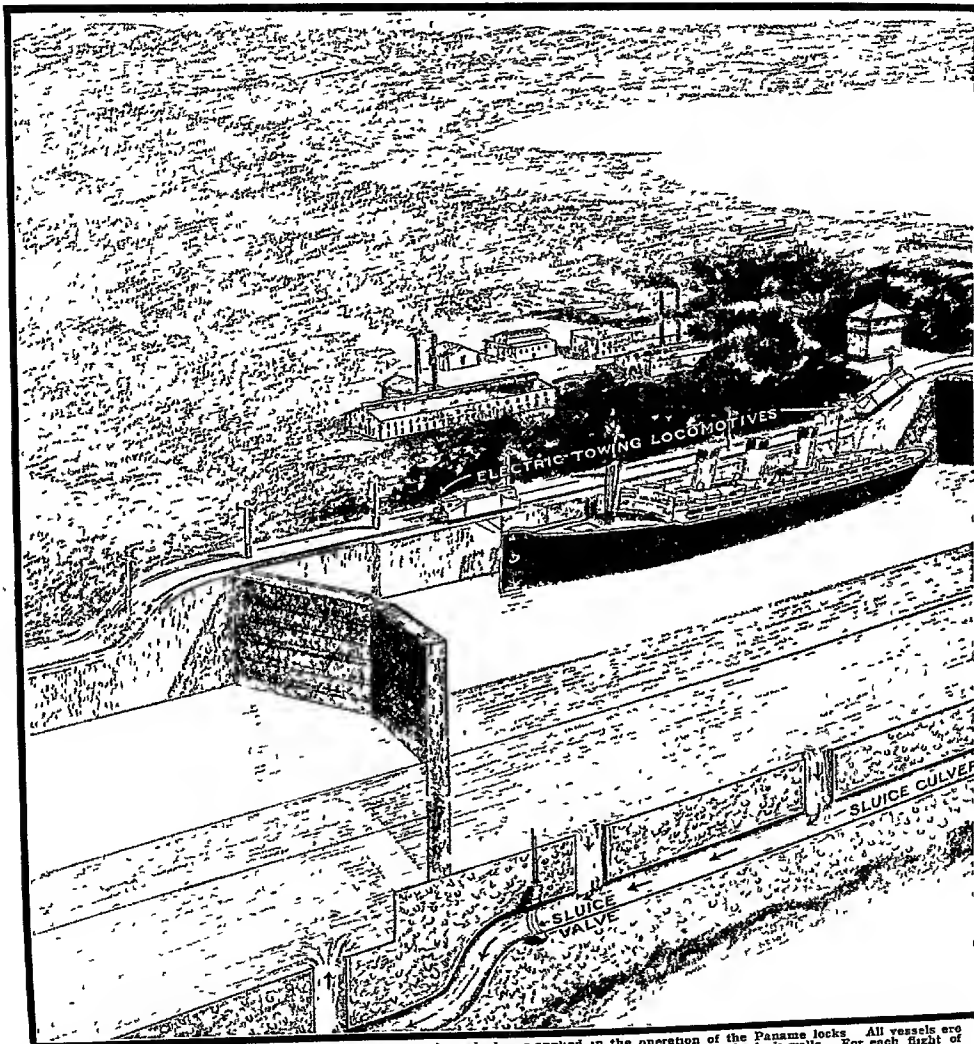


Electric locomotives draw the ships through, thus avoiding the danger of damage to the locks, which would be almost certain if ships were allowed to proceed under their own power. This ship has entered the lock from the Atlantic side and will be raised to the level shown by the blackened sides of the enclosure before proceeding into the next lock.



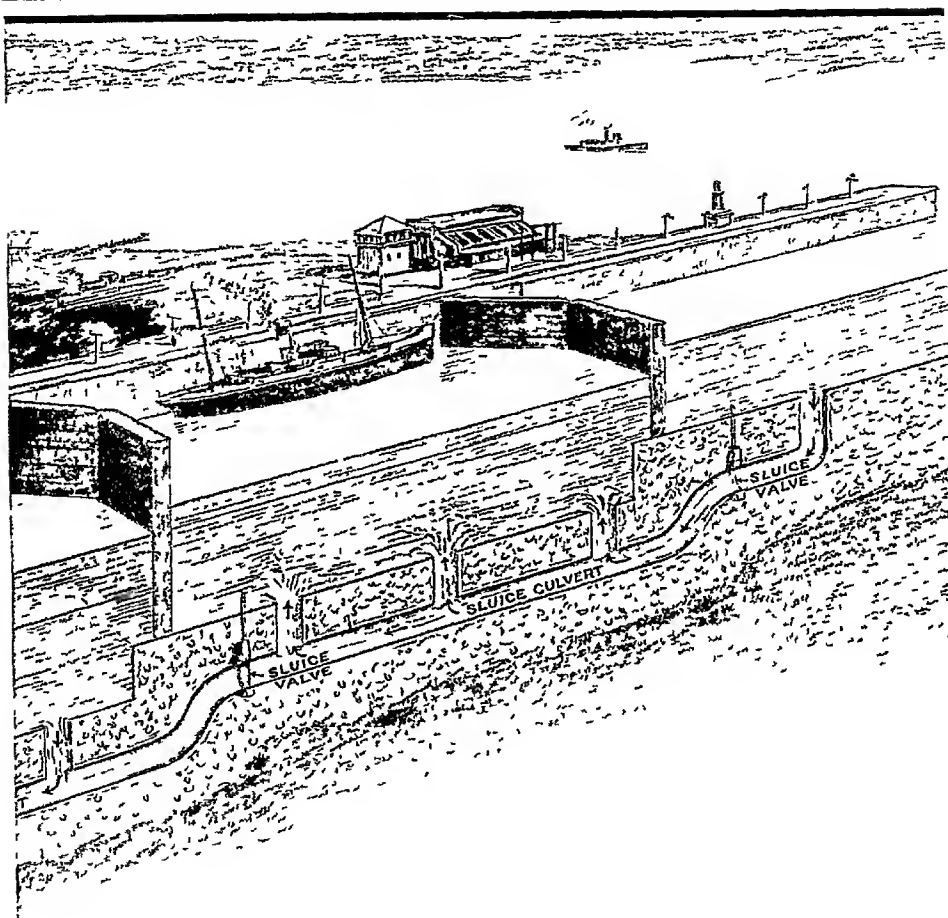
The battleship Arkansas, sister-ship of the Wyoming, is passing through one of the locks at Gatun. The canal will accommodate the largest American battleships. Ninety per cent of all the vessels on the high seas are less than 600 feet long, and would pass through the locks with plenty of room to spare.

HOW THE MIGHTY LOCKS OF THE PANAMA CANAL



This drawing was made so that you could see the principles which are applied in the operation of the Panama locks. All vessels are towed into and through the locks by electric locomotives, which run on cog-rails laid on the tops of the lock walls. For each flight of locks there are two towing tracks, one on the side and one on the middle wall. Usually four locomotives are required, two ahead, one on each wall, to pull, and two behind, one on each wall, to keep the ship in the centre of the lock and to stop it when necessary. Each locomotive is equipped with a slip drum and hewser, so that the towing line may be paid out or taken in without actual motion of the

LIFT THE GREAT SHIPS FROM OCEAN TO OCEAN



locomotive. The locks are filled and emptied through a system of culverts. To fill a lock, the sluice valves at the upper end are opened and the lower valves closed. The water flows through the culvert and up through the holes in the floor into the lock chamber. To empty a lock the upper valves are closed and the lower ones opened. The water then flows out of the lock chamber through the culvert, and out into the lower lock or pool. The main culverts under the walls are 18 feet in diameter, while the smaller ones leading under the lock floor are 3½ feet across, allowing a rapid transfer of water.

American opinion, however, had mostly favoured the projected route across Nicaragua.

The withdrawal of De Lesseps' company directed attention anew to the Panama route, and in 1903 the United States bought out the French rights for about £8,000,000. An additional payment to the new Republic of Panama brought a confirmation of the transfer, the grant to the United States of the 10-mile-wide "canal zone," and cleared away all obstacles to active construction.

The task which the United States had assumed was to cut the continents in two at the narrow point from Panama to Colón. It sent 30,000, then 40,000, then nearly 50,000 men to do the work, and over this army of workers it placed two Army officers—Gen G. W. Goethals as engineer-in-chief, and Col William Gorgas as chief sanitary officer.

Making the Zone Healthy

Colonel Gorgas was worthy of that long line of scientists who have brought the triumph of modern medicine. He began by screening up all the houses, and ordered every household to cover up all vessels that held water. He drained lakes and swamps that had never been drained before, and poured out the filth of ages to the sea. He drained every ditch and pond that could be drained. Over those that could not he drained he spread a film of oil, so that the larvae of the mosquitoes in them could not breathe, and thus sealed up the breeding places. He cut grass jungles to the ground, destroyed all vermin, and burned all rubbish. He raised all buildings up above the ground, and screened windows, doors, and porches with fine wire screens. He screened every train, and on every train he put a hospital car. He ordered alcohol out of the Canal Zone, and made it prohibition territory. And the result of all these measures was that the forces of *Stegomyia* and *Anopheles* were put to rout, and from one of the most unhealthy spots in the world, the Isthmus of Panama became one of the most healthy.

Equally marvellous was the work done by General Goethals and his troops of engineers and workmen, with their giant excavators, dredges, and other machines, which excelled those of De Lesseps as much as the science of Gorgas exceeded that of the earlier French medical officers.

Henceforth for ten years you could have seen such a sight as the world perhaps had never witnessed since the building of the Pyramids or the Great Wall of China. The tropical sun beat down upon a vast panorama of industry. Swarming in the mighty cuts were legions of perspiring labourers, white and black, some in shirt sleeves, some almost naked. Some toiled with pick, shovel, and crowbar, and others with drill and dynamite in the stone cuttings.

Overhead cable railways and a network of railway lines were everywhere. The mighty derricks and cranes swung huge cement blocks through the air and lowered them into place to form locks and embankments. Powerful steam drills bored holes into solid rock at the rate of seven feet an hour. Monster dipper dredges rose and fell like signal arms from thumping machinery on barges in the swamps and bays. More than 100 steam shovels doing the work of 10,000 men dug up earth by ten-ton scoopsful and dumped it into waiting railway trucks. One hundred and fifteen locomotives were engaged in hauling trains of these trucks to the dumps, and there a thing like a great plough travelled from one end of a train to the other unloading 20 trucks, each carrying 600 tons, in less than ten minutes, and performing the work of 400 labourers. The earth which was excavated amounted to more than 239 million tons.

Instead of cutting a sea-level canal through the mountain divide as the French had planned, the American plan was to leave the central section 85 feet above sea-level, and to construct a "water stairway" of great "locks" by which ships could climb up one side of the divide and down the other end. Even with this advantage it was still necessary to make some cuttings more than 300 feet deep. The mountains were, therefore, blasted away with dynamite.

Once there was an earthquake. Heavy rains brought terrific landslides, which often undid the work of months. The river Chagres was particularly troublesome because of its floods, but it was conquered by the construction at Gatun of one of the mightiest dams in the world, made of earth and rock, a structure a mile and a half long, half a mile wide at the base, and 100 feet wide at the top. This dam connects the hills at each side of the Chagres valley with a hill in the centre, creating Gatun Lake, which has an area of about 165 square miles at normal level.

The Dream Fulfilled

So for nearly ten years the digging and dredging and building of concrete walls and locks went on. Then, on October 10, 1913, President Wilson, 4,000 miles away in Washington, pressed an electric button which sent a flash over wires and cables and set off a tremendous charge of dynamite that blew out a temporary dyke. A flood rushed through a rock-walled rift in the mountains, and the Panama Canal was a dream realized! The greatest engineering wonder of the world had been achieved. On August 15, 1914, just after the outbreak of the World War, the canal was first opened to the commerce of the world. The formal opening did not take place until six years later.

What is the "big ditch" like today? Imagine you are in a steamer just about to

enter the canal. On your right you see the steel-concrete piers of Cristobal (Christopher), the new port of the Canal Zone, on your left the white houses and red roofs of Cristobal's twin city, Colon (Columbus), which, along with Panama City, flies the flag of the Panama Republic. Past the great bronze statue of Columbus you sail into the canal across the low coastal belt through a channel 500 feet wide and 40 feet deep, the minimum depth of the canal. The tropical forest has been pushed back, but you see it on each side, with its great ferns, delicate creepers, and brilliantly coloured birds and blossoms. Then the shores begin to rise.

You sail seven miles, and suddenly the way is blocked by an enormous wall of concrete masonry, with a double steel gate in the middle. This is the entrance to the first of the three locks at Gatun. The right half of it opens in two leaves, seven feet in thickness and weighing perhaps 600 tons, and in you sail. Then you see that a central concrete partition, 60 feet wide, resembling a highway even to the lamp-posts, divides the canal into two sections, one for incoming, the other for outgoing vessels.

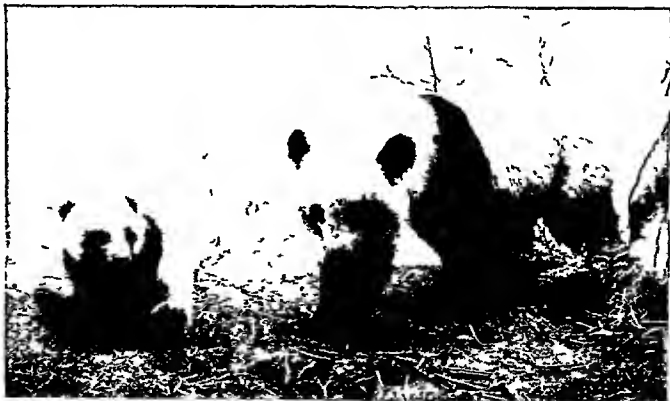
The engines of your ship are stopped, and four electric locomotives on cog tracks on the canal walls—which are 50 feet wide at the bottom and eight feet wide at the top—slowly tow the ship into the lock, by hawsers made fast to bow and stern. The gates close behind, shutting the vessel into the great chamber. Each lock is 1,000 feet long and 110 feet wide. From a huge unseen culvert water pours into the lock through great holes in the concrete floor, and your ship slowly rises until it is at the level of the next highest lock, then the gates open, and in you sail to the next lock. Twice the process is repeated, a half-hour being spent in each of the three locks, until the wonderful water stairway has lifted the ship to the 85 foot level of Gatun Lake. Here the engines start again, and you begin a 24 mile trip across this artificial lake.

Behind you to the right is the Gatun dam, holding in all those waters in this enormous elevated reservoir, which

supplies water to the locks. At the centre of the dam is a concrete spillway to let the surplus waters escape through 14 gate-controlled openings into the lower Chagres, in order that the lake may be kept at the right level. Giant generators, run by this overflow, supply electricity for operating the mighty hidden machinery of the locks and spillways. In 1935 another huge dam was completed across the upper Chagres at Alhajuela. Thus Madden Lake was formed, affording a reserve for Gatun Lake during the dry season.

Everywhere the scenery is entrancing. A palm-thatched hut perches on every hill-top, and groves of trees, draped with vines and Spanish moss, lift their drowsy heads above the waters. From Gatun Lake you sail into the Gaillard Cut, a great gash through the central divide, more than 300 feet wide at the bottom.

Eight miles more, and you begin to descend the water stairway. Through one lock at Pedro Miguel the ship drops down about 30 feet, to the level of Lake Miraflores, two miles wide, and later two more locks lower you to sea-level. From here you can see in the distance the new American port of Balboa, on the Pacific side. A tram-car line runs down the coast to Panama City, the gay quaint old Spanish capital. Finally you steam 8½ miles through a 500-foot channel out into the deep waters of the Pacific. **Panda.** This is the name given to two strange mammals, one of which, the giant panda (*Ailuropus melanoleucus*), is numbered among the world's rarest creatures. It was first "discovered," in the shape of a single skin, by



GIANT PANDA—A RARE TIBETAN NATIVE

Only in the thick, impenetrable bamboo forests on the Tibetan borders of North China does the giant panda now exist, and the first two ever to be exported alive from their native haunts were lodged in the Chicago Zoo. Few specimens have even been shot, but those above, from an exhibit at the Academy of Natural Sciences, Philadelphia, give some idea of the animal's appearance.

PANDA

a French missionary in China, about 1870, but it was many years before a specimen was seen alive by any white man. So rare is it that natives of the places where it lives—areas of the "lost world" between China and Tibet—are often unaware of its existence. But in 1936 a cub of this animal was captured and taken safely to America, and there are stuffed specimens in one or two museums. The cub was induced by its captor to take food from a bottle by a man who dressed himself up in skins and pretended to be the baby's mother!

In colour the giant panda is white with a broad black "saddle" extending round the back and down the front legs, while the hind legs, ears and a patch round the eyes are also black. Full-grown, it weighs twenty-two stone.

The exact scientific status of the giant panda is still more or less undetermined, but it is probably a relative of the red-brown little panda (*Aelurus fulgens*), or cat-bear, which comes between the bears and the other carnivores. It is, however, herbivorous, feeding on bamboo shoots.

Pandora. According to the Greek legend, Pandora was the first woman on earth. When Prometheus (*q v*) stole the fire from heaven and bestowed it on mortals, Zeus caused a woman to be made to bring trouble to Man.

She was fashioned by Hephaestus, and each of the other gods conferred some gift, hence her name, meaning "all gifted." Aphrodite gave beauty, Hermes cunning and persuasion, Athene

PANSY

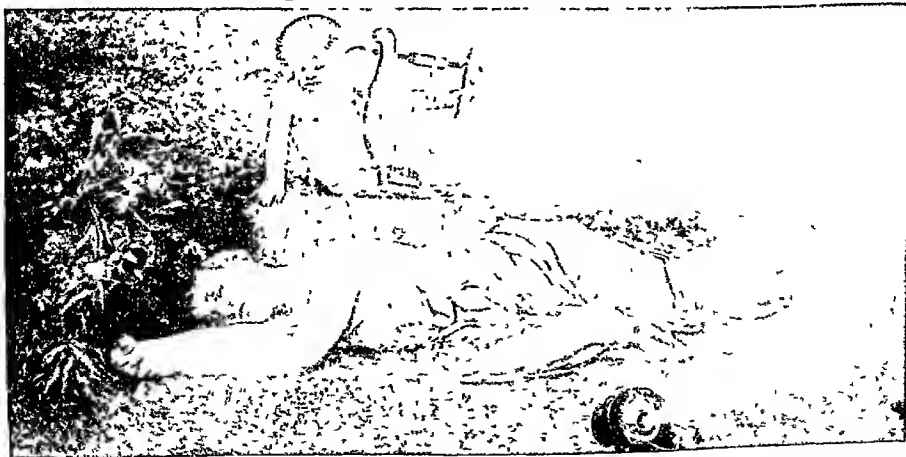
feminine accomplishments. Zeus sent her to Prometheus' brother, Epimetheus, who gladly accepted her, though Prometheus had cautioned him against her. Pandora brought with her a jar or "box" in which were all men's ills and troubles. When the jar was opened these troublesome things escaped and spread over the whole of the earth, Hope alone remaining.

Another story has it that the jar contained all blessings, which would have been preserved for Man had not Pandora opened the jar and allowed all but Hope to escape.

Pansy. What is more charming and pleasing than a bed of these smiling flower faces nodding to you as they sway to and fro in the summer breeze, whether they are the many-coloured cultivated types or the simple wild species? The name pansy is taken from the French word *pensee*, meaning "thought."

This familiar garden favourite is a cultivated species belonging to the violet family. The story is that some 300 years ago someone carried specimens of the modest little wild flower from the woods to a cool moist place in his garden. There, in course of time, by selection and cross-fertilization, the flowers became larger and more brilliant, with rich colouring ranging from white and yellow into orange, dark brown, blue, violet, and purple, and so grew into the pansy of today.

Now we may buy the plants and set them out in beds in the garden, but the cheapest



AFTER PANDORA'S 'BOX' WAS OPENED

An old Greek myth says that after Hephaestus (Vulcan) had fashioned the first woman, Pandora, the gods were so pleased with his workmanship that they gave her each their choicest gifts, and Epimetheus, Prometheus' brother, made her his wife. But she brought with her a jar or "box" filled with Man's ills, which she opened, thus letting loose misfortunes on mankind, Hope alone remaining at the bottom. The artist here shows Pandora overcome by the terrible result of her curiosity.

way is to buy the seed. Seeds sown under glass in February or March produce plants ready to transplant in May, blooming in July if given proper care.

That the pansy is a favourite with everyone is shown by the quaint names given it, such as "heartsease," and many others. Shakespeare has immortalized the pansy in "Hamlet", "There's rosemary, that's for remembrance, pray you, love, remember, and there is pansies, that's for thoughts."

The scientific name of the common wild pansy is *Viola tricolor*, and it varies in colour from purple, yellow and white to plain yellow. In hilly districts large bright yellow pansies are common.

Pantomime. The Christmas pantomimes that are so popular an entertainment amongst both children and grown ups have a really interesting history behind them. In Roman times the pantomime was a play without words, in which the actors conveyed their meaning to the audience by gesticulation and dances.

Very much later this was improved upon by dressing up the actors in masks designed to represent their characters. This and the opera were the Italian contributions to the pantomime. In France the masked comedy developed into what was termed *vaudeville*, and when this was introduced into England (about 1723) it was called the pantomime. This was really quite a good name for it, because a number of these pantomimes were *dumb shows*, rather like the original Roman pantomimes.

Vaudeville Becomes Pantomime

But some of the vaudeville shows had a certain amount of opera and ballet introduced into them, and later they became very much influenced by the music-halls. Fairy stories such as "Mother Goose," "Cinderella," and "Aladdin" were incorporated so as to make the Christmas pantomimes really interesting for both the children and their parents. So pantomimes today, strictly speaking, should not be called by this name, for they are really a wonderful mixture of nursery story, music-hall, ballet, opera, and vaudeville.

Perhaps you had never thought of a pantomime as being anything more than a splendid nursery story come to life. But next time you go to see the pantomime remember that not only is it based on a great deal of tradition, but it has changed tremendously in the past



OLD FASHIONED PANSIES

Perhaps none of the flowers of the old English garden is so popular as the pansy. Modern varieties are many-hued, but almost all have the dark centres that you see here.

and is still changing. New devices such as the revolving stage permit the presentation of far more spectacular pantomimes than ever before. The introduction of new songs, popular "hits," the latest jokes, and modern ideas must all make the pantomime change. (One strange convention, however, that still lives on is for a woman to take the part of the "principal boy.") And to watch this change going on is every bit as interesting an occupation as watching the pantomime for its own sake.

Papacy. The "Papacy" means the office of the Pope, and also denotes the system of ecclesiastical government in which supreme authority is vested in the Pope. The word "pope" is the English form of the Latin *papa* (Greek *papas*), meaning "father." The title Pope was in early times given to all bishops, but later it came to be restricted to the Bishop of Rome as supreme pontiff of the Roman Catholic Church.

The head of the Roman Catholic Church has other titles, such as "Most Holy Father," "Vicar of Jesus Christ," "Pontifex Maximus" (literally, "chief bridge-builder," a title used by the ancient Roman priesthood), and *Servus Servorum Dei* ("the servant of the servants of God").

Primacy of St Peter

According to Roman Catholic teaching, Christ in founding the Church as a visible institution gave to St Peter primacy over the other Apostles, and made St Peter His representative on earth by investing him with the three prerogatives of king, priest, and teacher, also bestowing upon him the highest legislative, priestly, and doctrinal authority. The primacy had been promised to St Peter before the Resurrection, and was conferred when Christ manifested Himself to St Peter and the other Apostles on the banks of the Sea of Tiberias (This teaching is based upon what are termed the Petrine texts, found in Matthew xvi, 15-19, Luke xxii, 31, 32, John xxi, 15-17).

As the Church was to endure till the end of time, Peter must have a successor, who, as Bishop of Rome, should be the Vicar of Christ on earth. History bears testimony that from the earliest times the Bishop of Rome has always claimed the supreme headship of the Roman Catholic Church, and that this headship has been universally acknowledged by all within the fold. The Pope is Bishop of Rome, Archbishop



POPE PIUS CREATES A CARDINAL

Next to the Pope, a cardinal is the highest dignitary of the Church of Rome, and has the title "Most Eminent Lord." Above, Pope Pius XI, wearing a mitre, is seen in 1938 bestowing the red hat of the cardinalate upon Cardinal Hinsley, Archbishop of Westminster (kneeling), in public consistory. This is the only time when the red hat is actually worn; on other occasions the cardinal wears a red brette.

and Metropolitan of the Roman province, Primate of Italy, Patriarch of the West, and supreme pontiff of the Universal Church.

In virtue of his position as head of the Roman Catholic Church, the Pope is its supreme teacher, legislator, judge, and governor. As teacher he formulates what is to be believed by the members of the Church, and takes measures for the preservation and the propagation of the faith. As legislator he exercises supreme jurisdiction and may legislate for the whole Church. The Pope is the supreme judge of all matters of faith and morals. And, finally, as governor, he has the right of appointment to public ecclesiastical offices, such as the nomination of bishops,

Holy See, and of State.

This official is, perhaps the best-known of all representatives of "the Vatican," as the Papacy is called from the place of the Pope's residence, for all the political affairs of the Church, its dealings with foreign nations, etc., are conducted through him. Also from his office those less formal public letters known as papal "brefs" are issued. The members of the Congregations, as well as other chief administrative officers, are almost always cardinals. (See article on Cardinals)

The Pope has primacy of honour as well as primacy of jurisdiction over all bishops of the

the establishment of dioceses, and the approval of religious orders.

Though the Pope's authority is supreme, it must not be understood that it is either arbitrary or unrestricted. He is directed in the exercise of it by the spirit and practice of the Church by ancient statutes and immemorial customs, by the very purpose of the Papacy as expressed by Christ at the time of its institution "Feed my lambs feed my sheep" (John xxi, 15-17).

The Pope is aided in his administration by a number of commissions, tribunals, and offices, collectively known as the *Curia Romana*. The commissions, known as the Roman Congregations, each deal with some special branch of work, the Congregation for the Propagation of the Faith, for instance, has supervision of missionary activities. There are three tribunals, the Sacred Apostolic Penitentiaria, the Sacred Roman Rota, and the Apostolic Signatura, the last being the supreme tribunal. Among the offices are the Apostolic Chancery, which sends out those formal documents issued under the Pope's seal called "bulls" (from the Latin *bulia*, a leaden seal) for the establishment of new dioceses and chapters and the like, the Apostolic Camera (Chamber), in charge of the administration of the property of the the office of the Secretary

Church He ranks first among Catholic princes, is independent of every temporal ruler, and in Catholic countries his ambassadors have precedence over other members of the diplomatic corps.

For fully ten centuries the Pope was a temporal as well as a spiritual sovereign, and ruled a district stretching across central Italy, from sea to sea, known as the Papal States or "the Patrimony of St. Peter." Temporal power was wrested from the Papacy in 1870, when the present kingdom of Italy was formed, with Rome as its capital. The breach was healed in 1929 by virtue of the Lateran Pact of Reconciliation, when an area of some 108 acres became an independent sovereignty as the Vatican City State.

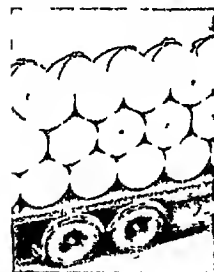
The Papacy is the most venerable of existing institutions. We can trace the line of Roman pontiffs in an unbroken succession back through the centuries from the present occupant of the papal chair to St. Peter.

As to the manner in which the Pope is elected, the method has varied at different periods. In early days the Pope was elected by the clergy and the faithful of Rome. At the present day the election is made by the College of Cardinals assembled in conclave. The usual form is the "scrutiny," or secret ballot, in which to be successful a candidate must receive a two-thirds vote, the voting takes place in the Sistine Chapel. (For a complete list of the Popes see the entry "Pope" in the Fact Index.)

The Romantic STORY of PAPER-MAKING

Without paper the invention of printing would have been useless, and without printing the world would be little advanced beyond the Dark Ages in respect of its knowledge, which, unless spread, is of little value.

Paper. Every where we turn we find paper. Think how many newspapers (daily and weekly) there must be in the world, watch the huge rolls



of newsprint, many miles long, reaching the newspaper offices. Think of the vast libraries of books running into many millions and of the scores of thousands that pour from the publishers every year. We wrap our parcels in paper. Our snapshots and all our photographs are printed on sensitized paper. We use paper for writing.

Tins, as well as bottles of medicine and chemicals, have paper labels. The walls of our houses are decorated with wall-paper. Cardboard boxes or "cartons" are used for countless purposes. The sandwiches which we eat at picnics are wrapped in oiled paper to keep them moist and fresh. It would be difficult to think of life today without paper.

The first paper makers still ply their trade just as they have done for ages and ages. They are not human beings, but wasps, and it is said that a Chinese sage, watching some of these insects building their nest, got the idea which resulted in the first Man made paper. At all events, the Chinese were making paper in very early times—apparently before the Christian era.

The early Egyptians, 3,000 years or so before the Christian era, made a writing material from the papyrus plant (from which comes our word "paper") that grew in great profusion on

the banks of the Nile. This papyrus "paper" was made by laying thin sheets of the stem with their edges overlapping across other sheets at right angles to them. The whole was moistened with water, pressed down, and the rough places smoothed off with ivory or a smooth shell. The sheets were glued together, either by the natural gum contained in the fresh stems or by some other adhesive, to form a tough white or ivory coloured sheet, which with age became brown and brittle like the papyrus we see in museums now. Papyrus for documents and correspondence was exported from Egypt to Rome and Greece, and was so indispensable that a failure of the Egyptian papyrus crop during Tiberius's reign threatened to upset the whole business of life in the Roman Empire.

It is said that the failure of a king of Pergamum (which was once one of the greatest cities of Asia Minor) to obtain the papyrus he needed for the enlargement of his library led to a return to the old custom of using carefully prepared skins of goats, sheep, and calves for writing material, and from the new vogue given to this material it came to be called "parchment" (from "Pergamum").

Between the 3rd and 7th centuries parchment and vellum (a very fine parchment made of calf skin) displaced papyrus in Europe. The wonderful illuminated manuscript books of the Middle Ages were written on the new materials, which possessed the merits of great smoothness and toughness. These were the only available writing surfaces in Europe until the Saracens carried to Spain the art of paper making, which they had learned from the Far East.

The spread of the new art was slow, and paper did not become common until the 14th century.

PAPER

It gradually superseded parchment and vellum in the 15th century—just in time to establish the usefulness of the new invention of printing.

Practically any fibrous or cellulose-containing vegetable material can be used for making paper (*See Cellulose*). In Asia the bark of the paper-mulberry was generally used. Cotton and linen rags, cleaned, soaked, boiled, reduced to a pulp by beating and grinding, and the pulp then spread in thin layers and dried between sheets of felt, were the materials most widely used by the paper-making industry in Europe until the middle of the 19th century. Rag papers, made by hand, sheet by sheet, though

for fine papers. The finest writing papers are made altogether of linen rags—old rags for the softer papers, new linen rags and waste for bond paper. The best tissue papers are made of hemp and rag. Wrapping papers are made of all kinds of fibres—wood-pulp, straw, jute, old rope and twine, china-grass or ramie fibre, Manila hemp (whence the name “Manila” paper), and old paper.

Newsprint papers, in countries where wood is plentiful or can be readily imported, are made from wood-pulp, rags, straw, and esparto grass (a Spanish grass) are used elsewhere. The paper of this book is made of wood-pulp.

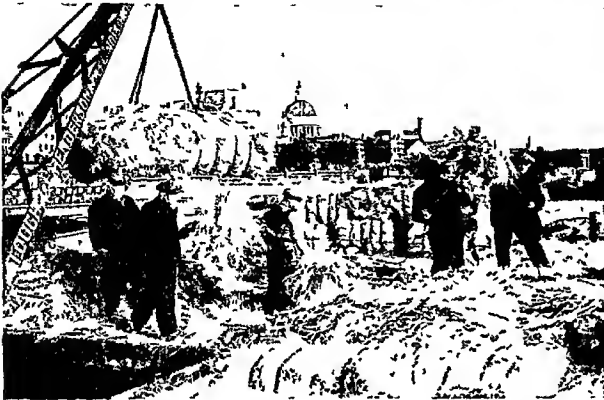
Wood-pulps are divided, according to the processes by which they are made, into mechanical or ground pulps and chemical pulps, the latter including pulps made by the bisulphite, soda, and sulphate processes. The soda process is used for poplar, beech, and other soft deciduous woods, while the girding, bisulphite, and sulphate processes are used for coniferous woods. Whichever the process, the logs (usually from trees ten to twelve inches in diameter) are cut in 4-foot lengths, barked, and trimmed to remove knots, seams, and decay.

To make ground pulp, the blocks, placed in steel pockets against a revolving grindstone, are held firmly by hydraulic pressure, while water playing on the stone carries away the ground fibre. The pulp in the water is then strained through vibrating

screens to remove lumps, and, if necessary, bleached. In some pulp mills the pulp is at once made into paper, in others it is formed into sheets for sale to the paper-makers.

To make chemical pulp the log sections are chipped up and placed in a “digester,” where they are cooked for a number of hours in a chemical solution—caustic soda in the soda process, acid sulphite of calcium and magnesium in the sulphite process, and sodium sulphate in the sulphate process.

The real making of paper begins in the “beater,” a huge oval tub furnished with a revolving horizontal roll set with knives like a paddle-wheel. The quality of the paper depends on the material furnished to the beater, the length of treatment, the character of the knives, and other features of the machine. In the beater a mineral “filler” (e.g. china-clay, or sulphate



Associated Press

GRASS FOR THE PAPER MILLS

The seemingly rural scene above is not, as a first glance suggests, hay-making on the Thames. The labourers are unloading esparto grass from barges near Blackfriars Bridge, and this graceful feather-grass will be used for making paper. In the background can be seen the dome of St. Paul's Cathedral.

far cheaper than parchment, were yet much too costly to render practicable a modern daily newspaper, with its many huge double sheets to a copy and its edition of more than a million copies daily.

About the beginning of the 19th century the modern process of paper-making by machinery was invented, and by the middle of the century it had supplanted the hand processes for all but the very finest grades.

Meanwhile, all kinds of vegetable fibres were being tested in paper-making. The huge expansion of the paper-making industry followed on the perfection and general adoption of processes for making printing paper from wood-pulp, in the second half of the 19th century.

By far the greater part of the world's output is now made from wood-pulp. Linen and cotton rags and flax waste and sweepings are still used

HOW TREE TRUNKS ARE MADE INTO BOOK LEAVES

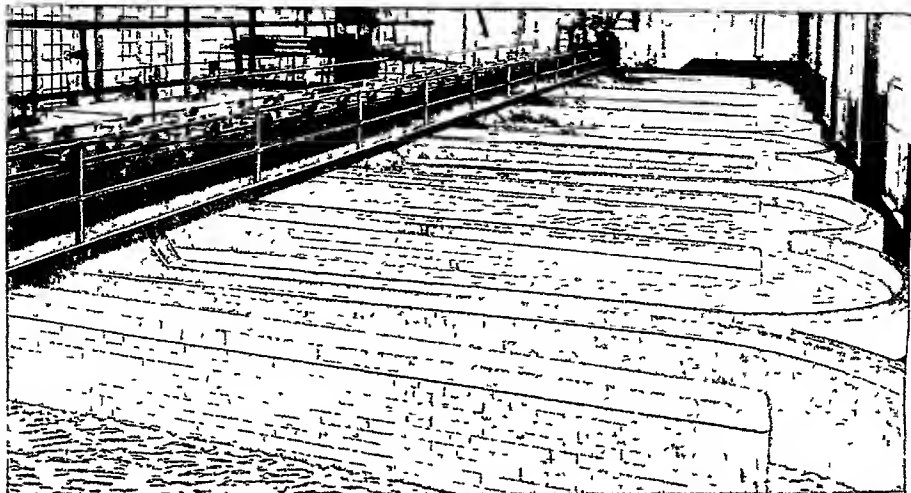


Here are sections of trees starting on their journey to become "educated"—that is, to become paper upon which much interesting information will be impressed. The logs, cut into 2-foot lengths, are barked and trimmed of all undesirable parts and sliced up into small chips. The photograph shows a man sending a log to visit the revolving knives, while a chute carries its chopped-up brothers to the "digester" tank below.

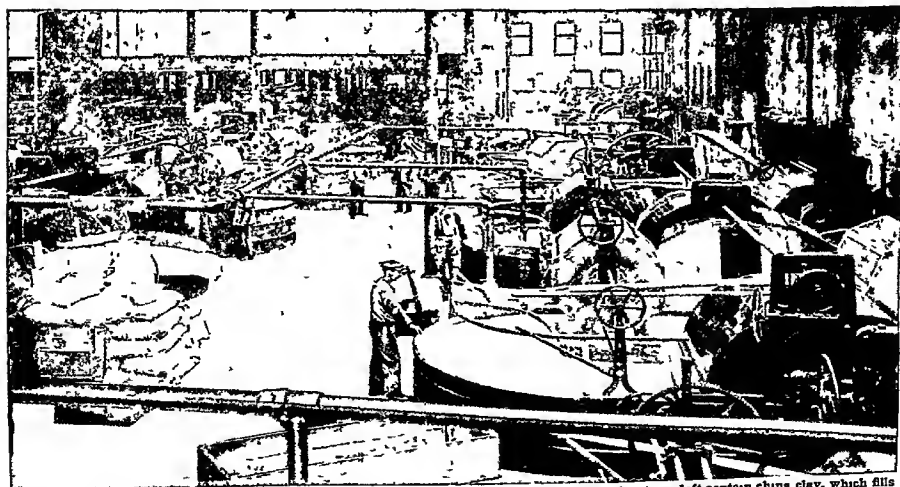


As this huge tank must have something with which to "digest" the chips, the sulphur burner in the picture on the right lends a hand. It converts sulphur into gas which travels through a water-cooled pipe into a lime tank. Here the lime and gas combine, forming the sulphate solution (bisulphate of lime). The chips and sulphite go into the "digester" and steam is forced in. When the chips have cooked several hours in the solution, all impurities are dissolved and the fibres separated.

WHERE THE PULP TURNS PALE AND IS 'FATTENED'

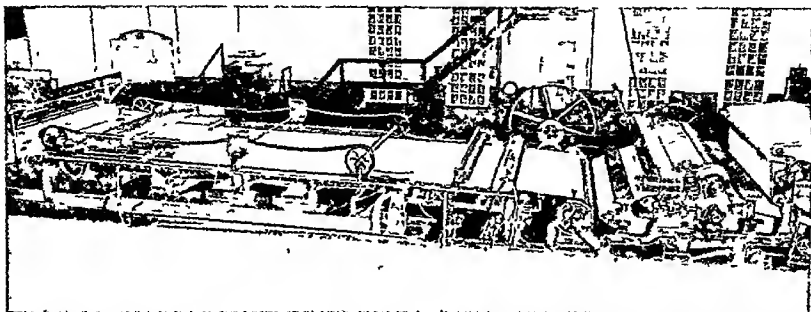


After the thick creamy mass has been blown from the digester, and washed and filtered through screens, it is drawn into large tanks called "bleachers." These are filled with a solution of bleaching powder, which bleaches the pulp to a milky white. It now receives another of its many washings and is ready for the next step.

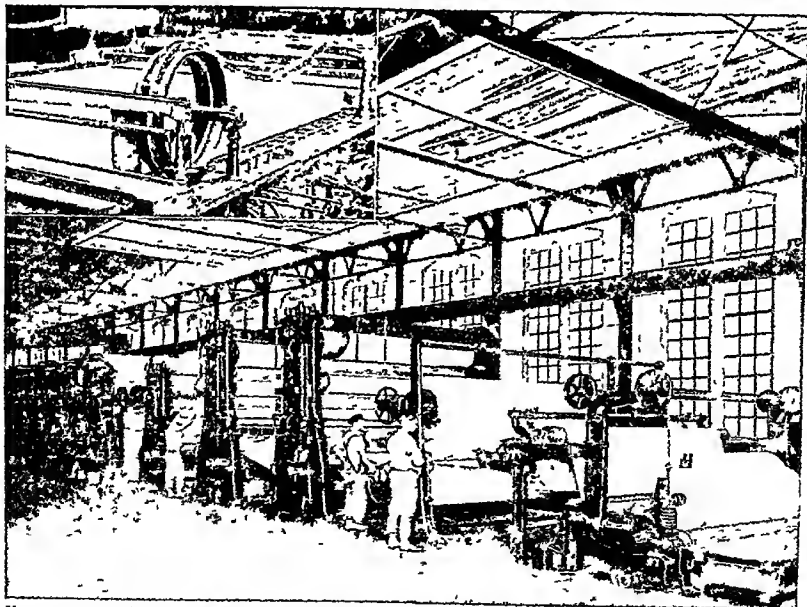


Let us visit a modern "heater" room, where the actual making of paper begins. The sacks at our left contain china clay, which fills up the pores of the paper. Other containers are filled with sizing, used for hard finish stock, and with coloring matter, for making colored paper. The pulp is piped into the oval heater vats and mixed with the necessary amount of clay and other ingredients. The larger the revalving paddle wheel, having knives for its paddles, further separates the shreds while it mixes the ingredients. The longer the heating the better the paper.

HOW THE MILKY STREAM IS IRONED INTO PAPER



Flowing through a strainer into the head box at the left, the pulp spreads out on an endless copper screen, so finely woven that the fibres remain while the water drains off. This screen moves forward with a side-to-side motion, which settles the fibres and kinks them together. Look at the first roller toward the right, it is a suction roller, and extracts excess water as the pulp passes over it. The moist fibres now advance between blankets of wool felt to a series of brass rollers. And here real paper begins to appear. The rollers squeeze out the remaining moisture and incorporate the fibres into a continuous sheet of paper, then pass it on between a long row of steam-heated metal rollers, pictured in the lower photograph, which dry and harden it as it progresses.



If you were to start from the wet end of the machine, shown in the upper left-hand corner, and leisurely walk the length of the machine, you would be keeping abreast of the same mass of pulp and you would learn how really short a time it takes for the wonderful Fourdrinier machine to iron the milky stream out into beautiful fine-textured paper such as you see in the large photograph.

of lime) or starob is often added, to fill the pores and give weight to the paper. Dyes and resin sizing are added if desired. The size forms a coat of varnish on the fibres, rendering the finished product less absorbent.

From the beater the pulp or "stock" ordinarily passes through a "refining engine," in which it is still further mixed and beaten. The most common type consists of a cone set with knives revolving in a stationary conical case, the inner surface of which is likewise set with knives, the stock flowing between the cone and the case. It is then screened, thinned, and pumped to the paper machine proper.

The Fourdrinier machine, on which book, news, and writing papers are made, is the same, improved yet essentially unchanged, as that which revolutionized paper manufacture more than a hundred years ago. In this machine the liquid stock flows out on an "apron" of waterproof cloth by which it is spread over an endless belt of fine wire cloth, travelling horizontally over many small rollers, through which the water immediately begins to drain away. The belt is given a sideways shake as it runs, so as to felt the fibres crosswise as well as lengthwise.

For newsprint the belt may be wide enough to make paper 200 inches wide, running 500 feet or more a minute. For book and writing papers the width is from 60 to 150 inches and the speed 80 to 400 feet a minute. "Wove," "laid," and "watermarked" papers, before leaving the wire belt, pass under a light wire roll called the "dandy," which impresses the proper design upon the paper.

From the wire belt the still moist tender web of paper passes, supported on a belt of felt, through two or three pairs of massive press rolls. From these it runs alternately over and under a number of steam-beated metal cylinders, the "driers." Fine papers may now receive a "tub" sizing in a vat of gelatine solution.

'Calenders' Give Smooth Finish

Next the paper passes through the "calenders," a stack of chilled iron rolls which smooth it, producing a "machine finish." It is then wound on a reel and passes to the "slitter," which trims the rough edges and, if necessary, cuts the roll into two or more narrower ones. The paper is now ready for use.

Fine papers for some kinds of book and magazine work may be "super-calendered," or given a hard smooth finish in a supplemental calendering through alternate chilled iron and paper rolls under great pressure, or they may be "coated" with glue or casein and china-clay or some other mineral which gives a smooth surface, but softer than that of super-calendered papers. Glazed papers of the type used for covering paper boxes are given a very glossy finish by calendering in a special machine.

Cardboard, strawboard, binders' board, building board, heavy papers, and most tissue papers are made on various modifications of the Fourdrinier machine. Machines for making heavy boards are so arranged that the sheets from several cylinders meet and are pressed together as they leave the wire cloth. The course of the paper or board after it leaves the cylinder is similar to that of paper made on the Fourdrinier machine.

Papers Made from Rags & Straw

The very thin, tough, and opaque paper called "Bible paper," the best-known type of which is the Oxford India paper, is made of linen rags with starch or minerals added to give opacity. The very strong translucent "parchment paper," used to protect the corks of toilet preparations and for other purposes, is made by dipping ordinary unsized paper into sulphuric acid and quickly washing out the acid. "Wove paper" is passed through a machine that coats it with melted paraffin. Most so-called "rice-paper" is not, properly speaking, a paper, but a natural tissue derived from the pith of a small Fomosan tree, and it has nothing to do with rice. It is used for the manufacture of artificial flowers, for the painting of small pictures, and for the manufacture of sun hats. But paper made from actual rice straw is also called "rice-paper."

The demand for wood-pulp grows greater each year, and this means the annual cutting of hundreds of thousands of acres of timberland. Britain's supply of pulp comes largely from Newfoundland, Canada, and Scandinavia. The paper shortage during the World War was a forcible reminder of the condition which will confront us before long if we do not provide for the future. The waste from the lumber industry is one important but neglected source of supply. While wood-pulp remains the cheapest and most readily available material up to the present, probably necessity will drive us to this utilization of other plant fibres in its place. Not only coniferous trees but also aspens and poplars are used for paper pulp.

Paper is made in a great variety of sizes. Most newsprint paper is made in huge rolls, varying in width from 30 to 75 inches. The sizes of British printing paper range from foolscap (17×13½ inches) to imperial (30×22 inches), the sizes of writing and drawing papers vary from pott (15×12½ inches) to emperor (72×48 inches). There are eight recognized sizes of brown paper, ranging from 21×18 to 46×36 inches. (See also under Books)

Papyrus. This reed (*Cyperus papyrus*) was very widely cultivated in ancient times in the Delta of Egypt, where it was used for many purposes, especially for a species of paper prepared from the pith, and itself known as papyrus.

It grows from three to ten feet high, with long sharp keeled leaves, and soft naked stems as thick as a man's arm at their lower part, it is topped by numerous long drooping spikelets of flowers. The more slender stalks were woven into baskets, and the thicker ones, tied into



PARACHUTES IN PLENTY

This amazing photograph shows part of a mass parachute descent made near Moscow at a festival of Soviet aviation. One hundred and fifty parachutists jumped simultaneously from six planes, filling the sky with a rain of white "petals."

bundles, were made into light boats. The fibre furnishes material for cordage, sails, awnings, and matting. The pith, besides being used for paper, was once an important food of the poorer classes, and the root was dried and used for fuel and in the manufacture of utensils. The papyrus plant is now extinct in Lower Egypt, but still grows in the Upper Nile regions.

Parachute. (From *par'*-a *shōōt*) Hold aloft an open umbrella and try to pull it down quickly. You will find it difficult because the air offers so much resistance. This same resistance enables the parachute, which looks and acts very much like a giant umbrella, to "protect against a fall," which is the meaning of the name (from Italian *para*, ward off, and French *chute*, fall).

The parachute is the great life-saver of the airman, often providing the only means of escape when the aircraft catches fire or is otherwise disabled in mid-air. Every member of the R A F wears one when flying. Small parachutes are also used to drop messages, flares, or supplies to points where an aeroplane cannot land, and a development of this is seen in the "mass-jumps" practised in Russia. There, at military manoeuvres, large numbers of soldiers are dropped by aeroplane.

A parachute is made of specially prepared long-fibre silk of great strength and elasticity and of light weight. It is left raw, that is, untreated, so that it will not take a crease. About 36 shrouds or lines of strong silk cord are evenly spaced around its circumference and connected to the flyer's body harness.

The standard Service parachute is 24 feet in diameter, and is folded into a pack 18 inches square and weighing 18 pounds. It may be worn on the back, or on the lap, or used as a seat. The packing must be done very carefully so that the lines will not become twisted. On top of the folded 'chute goes the little pilot 'chute, about three feet in diameter. The bundle is held together by two pins running through slots in the outer covering. Attached to each pin is a very strong flexible steel cable, known as the "rip cord," which is connected to the release ring on the jumper's left side.

When making a "free fall," a parachutist jumps from his machine, counts "three" slowly, and then pulls this ring, thereby pulling the pins out of the slots. The flaps of the bundle fly open and out pops the pilot parachute, driven by the force of its powerful springs. This drags after it the big parachute, which opens in about two seconds and suddenly checks the airman's fall. A vent in the top of the parachute regulates the flow of air through it and controls the rate of descent.

Another kind of parachute jump is the "pull off," used in the R A F for training



HOW A PARACHUTE IS WORN

Stowed away in the bag or pack which is worn by this airman is a wonderful canopy of silk with silken cords attached. One strong pull on the ring at which he is pointing, and the pack flies open, setting free the parachute to carry him away from danger and safely to earth.

The novice parachutist stands on the wing-tip of the aeroplane, pulls the rip cord, and is himself pulled off by the pilot's chute. The jumps from a record height, such as that of 36,000 ft. claimed by a Russian in 1937, are usually achieved by a "delayed drop"—i.e., the rip cord is not pulled until after dropping a considerable distance. The greatest post-war parachutist—John Tranum, the Dane—used to make all his long jumps with a delayed drop. Five hundred feet is the lowest at which a jump can safely be made, below that it is doubtful whether the 'chute will open in time.

Paradise, Birds of. Gorgeous wingless and legless birds that floated through the air sustained only by their ample plumes and that died if they touched the earth! Such is the description of these tropical birds of the Australasian regions given by the early Dutch explorers, the first Europeans to see them in the freedom of their wild state. They could not believe that the brilliant rainbow plumage of the birds could have been grown amid earthly surroundings.

As proof of their statement that the birds lived entirely in the air, the travellers displayed

cured skins given them by the natives. From these skins the wings and feet had been so skillfully removed that the great Swedish naturalist Linnæus himself did not detect the trick, for he named the principal species *apoda*, that is, the "footless" bird.

Naturalists have now studied them in their native haunts, and, while finding them quite worthy of the extravagance of their name, have related them to no more heavenly group than that of the crow.

There are about 50 species, all confined to the tropical islands of the Pacific. They range in size from that of a crow to that of a sparrow, and of some sorts only single specimens are known.

The Great Bird of Paradise (*Paradisæa apoda*) is purple beneath, with head and neck of pale yellow, and forehead, cheeks, and throat of metallic green. Beneath its wings are tufts of delicate golden-orange feathers, which, when the wings are raised, fall over like the spray of a fountain. But all these colours have a more or less variable nature, according to the light in which they are viewed. During the breeding season the males "display" magnificently before the hen birds. (See *Frontis*, vol. 7).

The Red Bird of Paradise (*P. rubra*) has tufts of crimson, and in addition has elegant curling tail feathers 21 inches long. The Superb Bird of Paradise (*Lophorhina superba*) has on its neck a strange feather-shield which opens into a gorgeous fan-like circle.



SUPERB BIRD OF PARADISE

Of all these lovely creatures which we call the Birds of Paradise, this is perhaps the finest, and it is here seen at its very best, in the act of displaying its beauties before its mate. These birds live in tropical Australasia.

PARADISE

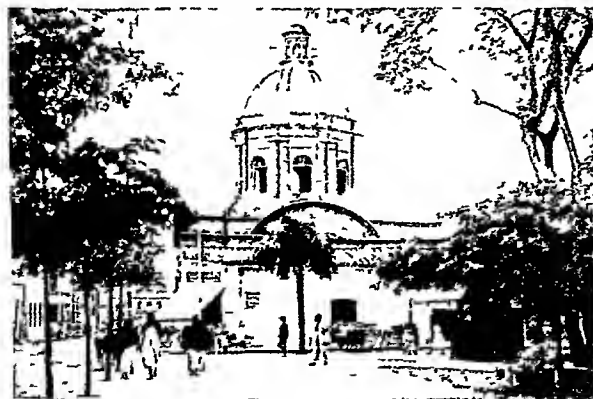
Nature gives the hen Bird of Paradise a plain dress, often of sombre browns. Her nest is placed in tall trees, where she takes entire care of the two or three eggs and of the babies after they are hatched. It seems probable that these birds are polygamous, one cock having a number of attendant hens.

Birds of Paradise seldom thrive for long when kept in captivity.

Paraguay. (Pron par' a-gwä). No South American State has a more tragic history than this little inland republic. It is the only one on that continent which has never had a seacoast, the smallest in population, and the third smallest in territory. Although it is blessed with such

Area—Paraguay proper 61,637 square miles, Gran Chaco area (claimed by Paraguay) 100,000 square miles. Total population about 700,000.
Physical Features—Hilly and densely forested in the east; grassy table-lands further west. Chief rivers: Paraguay and Paraná.
Principal Products—Hides, beef, other cattle products, yerba mate, timber, oranges, bananas and other fruit.
Chief Cities—Asunción (population, 100,000), capital; Villa Rica (30,000); Villa Concepción (14,000).

exquisite beauty and so delightful a winter climate that it has been called the Riviera of South America, its history has been a tale of suffering almost without parallel. It was crushed under the heel of Spanish despotism for two centuries, and gained its independence only to fall under the yoke of a trio of military dictators, who ruled it with a rod of iron.



GLIMPSES OF PARAGUAY

In the upper photograph we see a Lengua Indian carrying a fish spear, the Indians of Paraguay being experts in the art of spearing the larger species of fish. The capital of the republic is Asunción, where the body of the dictator Francisco Lopez lies buried in the building known as the Lopez Tomb, seen in the lower photograph.

Photos top: Miss G. Boulter; bottom, Ewing Galloway.

PARAGUAY

The last of these, Don Francisco Solano Lopez, plunged it into a war with Brazil, the Argentine, and Uruguay, which ranks as one of the bloodiest and most disastrous in history, in comparison with the population involved. So



enormous were the losses in battle and from privation that five sixths of the entire population (two-thirds according to other authorities) perished during the five years of the war, from 1865 to 1870, in 1873 there were only 28,746 men left, as against 106,254 women over fifteen years of age. And even in later times fate has continued to deal unkindly with the Paraguayans, for civil wars have devastated the land at frequent intervals.

Between 1904 and 1912 there were six of these conflicts, costing the country 30 per cent of its people. Even now the female population is several times more numerous than the number of males.

From the advent of the first dictator in 1814 until 1852, Paraguay was the hermit nation of the Americas. Foreigners were barred from its

PARAGUAY

borders and trade was banned as jealously as in Tibet. Even after the opening of the frontiers, intercourse with other nations was slow in developing, so it may be said that the history of Paraguay as a modern republic does not begin until the adoption of its constitution in 1870.

Paraguay proper is a territory of about 61,000 square miles lying between the rivers Paraguay and Paraná. It also claims an area of some 100,000 square miles between the Paraguay and the Pilcomayo, the title to which is disputed by Bolivia. Between 1931 and 1935 there was a terrible war between Paraguay and Bolivia over the possession of this immense undeveloped area.

This disputed region is part of the vast plain known as "El Gran Chaco," which here contains oil, extensive pasture lands and valuable forests. It is largely unexplored and is inhabited chiefly by wandering Indians. Paraguay proper is a low-lying land of fertile rolling hills and valleys, with dense forests and groves of palm, orange, and banana trees.

The soil is rich and under cultivation produces abundant crops of wheat, maize, cotton, sugar-cane, rice, tobacco, and fruits. But the chief agricultural industry so far has been the gathering and cultivation of *yerba mate*, "Paraguayan tea," which furnishes the favourite beverage of South America. Next in importance is the cattle industry, which supplies hides for export and meat for the meat-extract and canned beef factories. Oranges grow almost everywhere, in such abundance that, though most Paraguayans eat twenty or thirty a day, only a part of the crop can be used. Great quantities are exported to Argentina and Uruguay. They are used in the Paraná valley for feeding pigs. The extraction of "petit-grain oil" from orange leaves is a growing industry. The most valuable forest product is the *quebracho* tree, the bark of which is superior to any other as a source of tannin.

One of Paraguay's great needs is railway development. Only about 500 miles of line have been built, and where the waters of the great

PARASITES

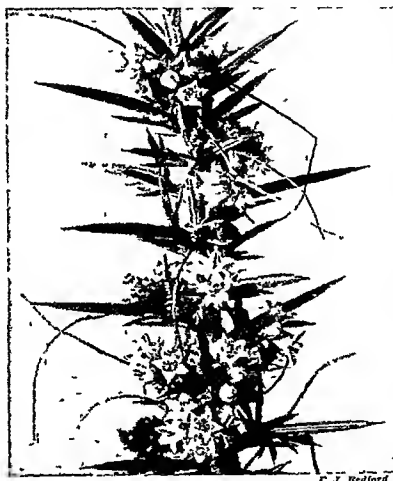
rivers are not available for transport, everything has to be carried in bullock carts over wretched trails of deep dust in dry seasons and almost impassable bogs in rainy weather.

The population contains a smaller European element than any other South American State. The percentage of white blood in most of the people is small. Like their ancestors the Guarani Indians, the Paraguayans are an easy-going, light-hearted race, with a strain of wildness that sometimes manifests itself in volcanic outbreaks of passion. The Guarani language is spoken more generally than Spanish. Italians form the bulk of the new comers, with Germans second.

Education is backward, schools are few and poor, and the majority of the population is illiterate.

The capital and chief city is Asunción, near the centre of the country on the river Paraguay. Villa Rica, about 90 miles south-east, on the main railway line to Buenos Aires, is an important shipping point. Villa Concepción, lying at the head of navigation for large vessels on the Paraguay, is another commercial centre.

Asunción was founded in 1535 by Juan de Ayolas, who ascended the Paraguay seeking a route to the wealth of Peru. In the 17th century Jesuits founded about thirty communities, which they ruled until their expulsion by the Spaniards in 1768. The Paraguayans declared their independence from the kingdom of Spain in 1811.



A DEADLY PLANT PARASITE

Here is a sprig of common furze or gorse, round which a dodder plant has wound itself. You can see the parasite's thread-like stems—for it has no leaves at all—and bunches of flowers, pale whitish-pink in colour. Dodder grows on a large variety of our English wild plants.

Parasites. When we see some grown healthy boy living at the expense of his hard-working father and mother, while he himself does nothing at all, we say, "Oh, he's no good, he's just a parasite." And so in the animal or plant kingdom whenever a creature lives at the expense of another, we call that creature a parasite, and his lazy way of life is known as "parasitism."

A considerable proportion of both plants and animals live partly or entirely by attaching themselves to other living things. All living animals, great or small, are liable to attacks by these unwelcome visitors. Man is no exception.

PARASITES

Many distinct species of parasites may attack various parts of his body, while the number of important diseases due to bacterial, fungal or virus parasites is large.

The number of parasites harboured by one host may be enormous. Several millions have been found in a single horse. About forty different kinds of parasites infest the dog, cattle and pigs have more. At least twenty kinds of parasites accompany the frog on his watery way. Even the great thick hide of the rhinoceros does not protect him from the tick. Birds and quadrupeds, fishes and whales, even insects, are all the unwilling hosts for myriads of smaller creatures. You remember the old rhyme of Dean Swift:

Great fleas have little fleas
Upon their backs to bite 'em,
And little fleas have lesser fleas
And so ad infinitum

Even the tiny protozoa, the one celled animals so small that we can see them only by the aid of a very powerful microscope, have smaller protozoa living on them.

The parasite usually gets not only its food from its host, but also warmth and protection as well, and the true parasite usually does nothing for its host in return. In fact, it more often than not injures its host, and, if present in great numbers, actually causes its death.

Parasites may live on the outside of the bodies of plants and animals, or inside. Examples of external parasites are the lice, fleas, and ticks of animals, and the plant lice and scale insects of plants, of internal, the best-known are the worms in the intestines of the higher animals.

Some parasites live for their whole lifetime on the body of the host. The bird lice are such *permanent parasites*. Their eggs are laid on the feathers of the birds, and the young descend to the skin when they hatch.

But fleas are of a different sort. The adults often leap off from the body of the host, and may even go to some other host, still more important, the young larvae are not parasites at all, but live as scavengers in refuse of all sorts.

It often happens that the young of certain animal parasites are provided with a full outfit of legs, but soon they settle down and lose their legs. During the rest of its useless life the parasite just sits attached to its host

and eats and eats, until it finally lays its eggs in its host's tissues and dies.

An example of this kind of parasite is provided by *Saccuhna*, which lives attached to certain kinds of crabs. This creature loses, not only its legs, but also everything else that would make it look like an animal. It becomes a mere bag for holding nourishment, which it gets from a series of branches penetrating the crab's body and sucking its juices up. Such a loss of parts is called *degeneration*.

Most internal parasites are degenerated in this manner. Many parasites which live firmly attached to their hosts have no legs or wings, and since they do not need to see their way



THE SHEEP TICK AND ITS CURE

One of the worst parasites of domestic animals is the ked or tick which infests sheep, its forepart is shown above, highly magnified. Every spring the sheep are 'dipped,' as in the top picture to get rid of these parasites and ensure against further attacks, and to make certain that no ticks are present when shearing takes place.

Photos top Fox Photos bottom J. J. Ward

about or watch out for food and enemies, they have also lost their eyes, ears, feelers, and other sense organs. Their food is predigested by their host, and so they have very simple alimentary canals or no canals at all. So too, their organs of respiration and circulation have degenerated, and they have become dull inert creatures at the lowest level of life.

Most of the animal parasites are found among the invertebrates. Among the vertebrates, the hag fishes or borers are long-eel-like creatures

which attack and eat larger fishes, remaining attached to their victim and being carried round with it while they are feasting on the muscles. The lamprey is another fish parasite which sucks the blood of its host, and both these forms show specially adapted development of the jaws.

The best-known parasites on plants are the scale insects, which attack especially fruits like the orange, grape-fruit, and lemon, as well as the bark of fruit trees (See Scale Insects). Other parasites on plants lay their eggs in the plant tissues, and the young live and feed at the expense of the plant when they hatch out.

Plants themselves are often parasites. Some, like the dodder, twine about other plants and send into the host little suckers to get the food. Thus the dodder and all other parasites like it are dependent on the host for both food and support. The lovely mistletoe, which we like so much at Christmas, is a parasite on poplar, lime, and other trees (See Mistletoe). A great many of the fungi particularly the shelf or bracket fungi, that grow on trees, are parasites. These may finally cause the death of their host.

The damage done by parasites, both plant and animal, is simply enormous. Rusts, smuts, blights, mildews, and various rots are among the most dreaded foes of the farmer, and are kept in check only by spraying and other preventive measures. One method which mycologists use is to infest the parasites with another parasite or bacterium, which, while poisonous to them, is innocuous to the

host. This is a form of "biological control" such as is practised in dealing with insect pests.

Not all parasites, however, are injurious to Man's interests. The harmful tussock moth, for example, is parasitized by some twenty insects whose larvae live in the young moth.

The difference between "parasitism" and what is called "symbiosis" is the difference between "sponging" on a friend and going into partnership with him. The most interesting case of symbiosis is the partnership between a fungus and an alga, which makes the lichen. This seems to be an instance where twice one equals one, for the alga is one kind of plant and the fungus another, and yet when they are added together, they make one plant—the lichen (See Lichen).

Paris. Since it had been foretold that Paris son of King Priam of Troy and Hecuba, would grow up to bring about the destruction of Troy, he was abandoned on Mount Ida. After being rescued by a shepherd and reared to manhood, he fell in love with the nymph Oenone, daughter of a river god. But he deserted her when the goddess Aphrodite promised him the fairest woman in the world for his wife, in return for awarding her the golden apple (See Trojan War). He carried off Helen, thus bringing about the Trojan War.

He himself was wounded in the conflict, and then returned to his long abandoned love, Oenone. She refused to heal the wound, and he died. Oenone, repenting too late, then put an end to her own life.

The QUEEN CITY of CULTURE

One of the most beautiful and best-planned cities in the world, Paris is the Mecca of artists and the metropolis of fashion. "London belongs to England," as the saying goes, "but Paris belongs to the world."

Paris, FRANCE. If you should ask travellers to vote on the question "What is the most charming city in the world?" the vote would surely be for Paris, the capital of France and the world's ninth city in point of size.



The Eiffel Tower

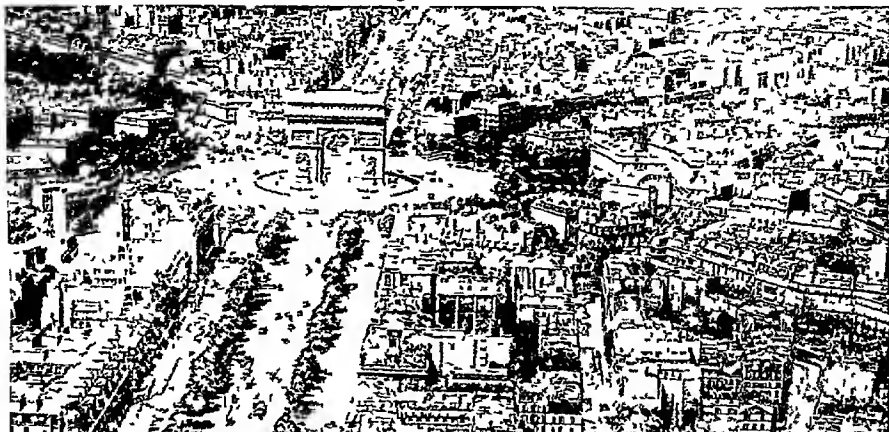
Painting, sculpture, architecture, all the arts in fact, are most at home there, and many who want to study them prefer to go to Paris. It is, too, the capital of fashion, and the latest Paris "creations" are regarded as the last word in dress design. It is known as the "gay city," for nobody is ever in a hurry and people always have time to sit at little tables on the

pavements drinking coffee and chatting, and at night Paris comes into its own as a metropolis of pleasure, its bright lights having formerly gained it the name of *la ville lumière* (the city of light).

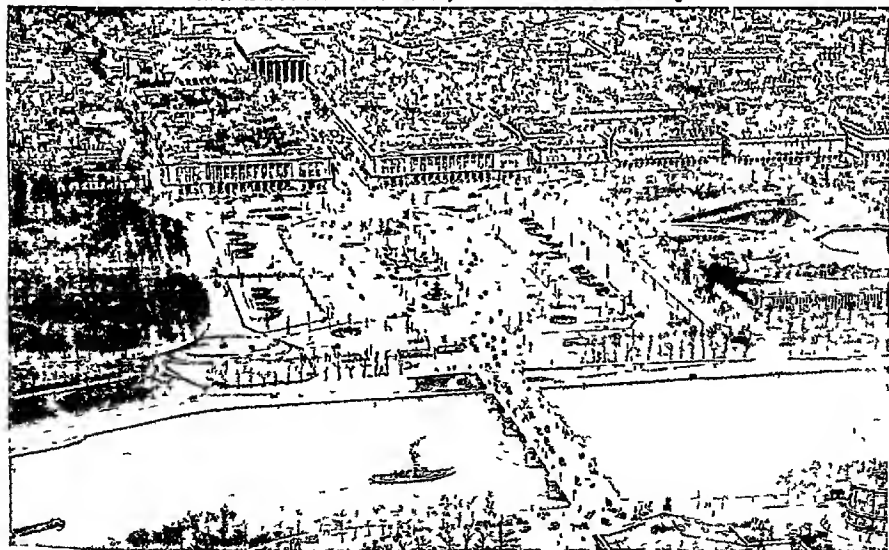
Though a manufacturing centre, Paris is much freer from smoke and fogs than London. The river Seine flows curving through the city, crossed by more than thirty beautiful bridges.

Paris was not made according to plan like London, it just grew. Under Napoleon III, in the second half of the 19th century, the great administrator Baron Haussmann made many improvements, including the laying out of the Bois de Boulogne and numerous boulevards, but in the older part of the city the streets run rather unevenly, making patterns of all sizes and shapes, like the pieces of a jigsaw puzzle. Now and again a large place, or open space, has been cut out, and broad boulevards have been constructed that go out from it like the point of a star. These boulevards are especially

TWO FAMOUS PARIS SQUARES SEEN FROM THE AIR



We are crossing Paris in an aeroplane. Before us is the Place de l'Etoile with the Arc de Triomphe in the centre. From here radiate some of Paris's most famous avenues and boulevards. The street nearest to us, leading to the arch, is the Champs-Élysées, which beyond the arch is known as the Avenue de la Grande Armée. Crossing the space diagonally, from the upper left-hand corner is the Avenue Foch, formerly the Avenue du Bois de Boulogne.



This is the finest of all the open spaces of Paris, the Place de la Concorde. That obelisk in the centre of the square is from the great temple at Luxor, Upper Egypt, and on either side are two fountains with the decorative sculptural figures so characteristic of French art. The bridge, which is one of the numerous handsome structures across the Seine, is called the Pont de la Concorde. Only pleasure steamers, such as the one we see, and smaller craft can pass under these bridges. The classical building at the end of the street leading from the bridge—the Rue Royale—is the Madeleine, a church which was built by Napoleon I as a 'temple of glory'. On the left of the square we enter the famous Champs-Élysées. On the right is the entrance to the historical Gardens of the Tuilleries.

beautiful and are always lined with trees. The houses and buildings are nearly all of light grey stone, and few are of any great height. The public buildings, parks, and bridges are almost all decorated with an unusual number of ornamental statues.

For many years one of the striking sights of Paris was the great wall—over twenty-two miles long, with fifty-seven gates in it, built between 1840 and 1845—that encircled the city. But at the close of the World War it was decided to demolish the wall and replace it by a continuous circular boulevard.

On the right or north side of the Seine are the business districts and, near the Trocadero Palace, the residential districts of the rich. The big park, the Bois de Boulogne, where fashionable

people go driving on Sundays, is on this side, and so is the Longchamps racecourse.

On the left bank is the Latin Quarter. This is so called because the University of Paris is here, and long ago, when all education was given in the Latin language, the students used to go about the streets singing their Latin songs. The students still go about singing, but now their songs are mostly in French. Many of the artists and students and political "leftists" live in the Latin Quarter to this day, and a queer, gay, poor, free place it is, like no other in the world. In recent years the artistic colony has followed a trend towards the Montparnasse district.

On an island in the middle of the river, where the original city of Paris once stood, and known today as the Ile-de-la-Cité, is the great Gothic cathedral of Notre Dame.

One of the most important places in Paris is the Place de l'Opera, where the Grand Opera House stands. They say that if you sit at a little table on the pavement front of any of the cafés there, and watch the people pass, in course of time you will see "everybody" in the world. It is very nearly a true saying, for almost every personage who goes abroad is sure at some time to reach the Place de l'Opera.

The magnificent Place de la Concorde, where the Egyptian obelisk stands, is one of the spots where the guillotine stood during the French Revolution. It is here that Marie Antoinette and so many others were beheaded during the Reign of Terror. The mourning wreaths which so long covered the statue symbolizing the city of Strasbourg, in this place, were removed when Alsace-Lorraine was restored to France. The Place de la Bastille, the Place Vendôme, the Place de l'Étoile, the Place de la Madeleine are also very fine and worth a visit.

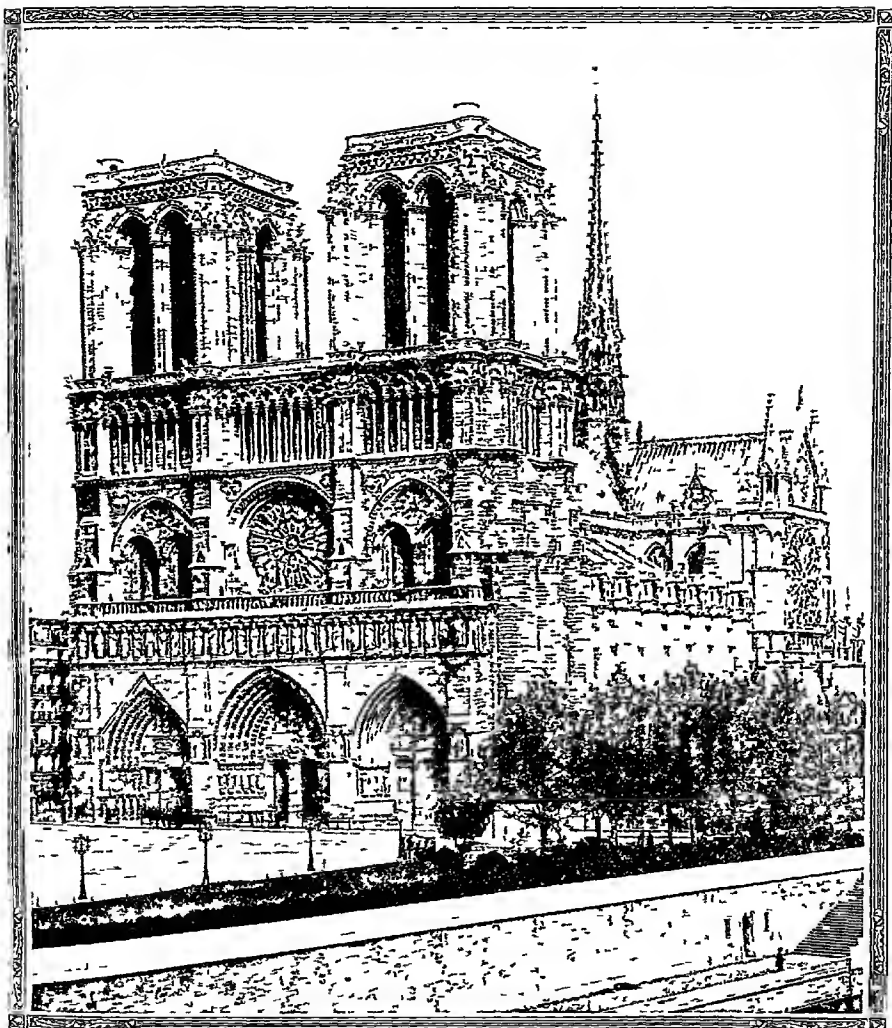
One of the greatest single monuments in Paris is the Arc de Triomphe (Arch of Triumph), begun by the great Napoleon "in honour of the victories of France." It stands on a hill at the end of the most beautiful boulevard,



THE 'YOUNG IDEA' IN MONTMARTRE

Here is a young "gamin" of Paris displaying his vocal talents at the opening, in Montmartre, of a new music school for children, run under the auspices of the Commune Libre du Vieux Montmartre, this is an organization which seeks to perpetuate the artistic traditions of this fascinating quarter of Paris.

NOTRE DAME—OLD PARIS CARVED IN STONE



For eight centuries this great church has stood on the narrow islet in the Seine River which forms the centre of Paris and has seen the tides of history sweep by. The good king, Saint Louis IX, passed through those massive doors to pray before he started away on his ill-fated crusades. The Paris mob during the French Revolution stormed these portals, tearing down the statues of saints and kings and setting their "Goddess of Reason" upon the altar within. Victor Hugo wrote about these walls stained with age his most famous romance "Notre Dame de Paris". The foundation stone of the cathedral was laid in 1163 by Pope Alexander III, at that time a fugitive from Rome, and the main edifice was completed about 1240. It was one of the earliest of Gothic churches, retaining some of the massive qualities of Romanesque architecture. It is 430 feet long and 170 feet wide. Its towers, which rise 223 feet above the street, are adorned with numerous "gargoyles" or grotesque figures of animals and demons.



SHOPPING QUARTER OF THE FRENCH CAPITAL

Two of Paris's biggest department stores are situated in the Boulevard Haussmann. One of these, Au Printemps, is seen on the left of this photograph, while further up on the same side are the Galeries Lafayette. One novel feature of these stores is that goods are sold from movable counters on the pavement outside. The street branching off to the right is the Rue Aubert, which leads into the Place de l'Opéra.

the Champs-Élysées (Elysian Fields). Under this arch passed, after the World War, the triumphal procession headed by Marshal Joffre and his guard of disabled ex-Servicemen. Another monument is the Vendôme column, a bronze pillar with spiral scenes in low relief. The metal for this column came from melted-down Russian and Austrian cannon captured in Napoleon's campaign in 1805.

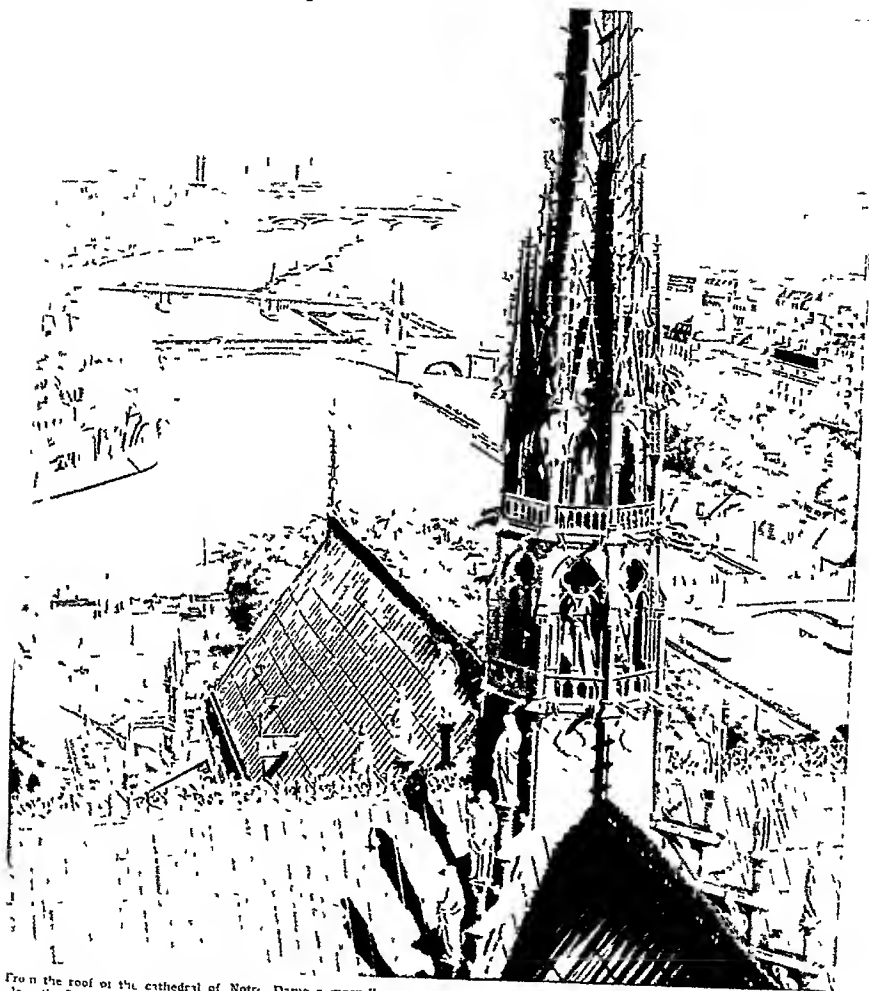
Paris has also many palaces—the Louvre, the Palais du Luxembourg, the Palais Royal, the Palais Bourbon, and so on. These used to belong to the kings. Since France has been a republic they have been, for the most part, public buildings, belonging to the nation or the city. The Louvre (*q v*) is one of the greatest art museums in the world. Painting and sculpture by living artists are housed in the Luxembourg Palace. The other palaces are mostly government buildings, where the work of ruling the country is carried on. For, as Paris is the capital of France, the President of the republic, the Senate, the Chamber of Deputies, the different Ministries, and the Embassies of the foreign nations are all here. The Foreign Office is in the Quai d'Orsay.

Paris has also many lovely gardens, two of them, the Tuileries and the gardens of the Lux-

embourg, being as beautiful as any in the world. The most famous streets of the city, are the Champs-Élysées, the Rue de Rivoli, which has arcades along it for miles, the Rue Royale, the Grands Boulevards, the Boulevard St Michel in the Latin Quarter (commonly called, in student slang, the "Boul' Mich'"), the Rue du Faubourg St Honoré, the Avenue Foch, the Boulevard St Germain, and the Boulevard Montparnasse. The most famous churches, apart from the cathedral of Notre Dame, are the beautiful Sainte Chapelle, built by St Louis in the Middle Ages to hold the crown of thorns and a piece of the "true cross" brought by him from the Holy Land, St Germain-des-Prés, where St Genevieve, the patron saint of Paris, is buried, and the modern church of the Madeleine. The Pantheon, formerly used as a church, is now a kind of temple of honour, where many of the eminent men of France are buried. On the hill of Montmartre stands the modern church of the Sacre Coeur, or Sacred Heart. It is built in the form of a Byzantine basilica, and can be seen from almost any part of the city.

Other famous spots are the Sorbonne, the seat of the science, literature, and other faculties of the University of Paris, the cemetery of Pere

BRIDGES OF PARIS SEEN FROM NOTRE DAME



From the roof of the cathedral of Notre Dame a marvellous panorama of Paris is seen before the eye. Looking up the river the Seine we notice on the right the vergerie of the Jardin des Plantes and on the left the quay of the Ile St. Louis. The same view bridge is the reconstructed Pont de la Tourne.

COLOURFUL STREET SCENES IN GAY PARIS



In the upper photograph is seen the 'terrasse' of a typical boulevard cafe. In winter, customers are protected by glass screens and kept warm by braziers. The Rue Royale links the Grands Boulevards with the Place de la Concorde, and at its northern end stands the fashionable church of La Madeleine, seen in the lower photograph. Its midnight Mass on Christmas Eve attracts thousands of worshippers.

PARIS

Lachaise, where many notable people are buried, the Hôtel des Invalides, for old soldiers, which contains a military museum and the magnificent tomb of Napoleon, the Palais de Justice, on the Île de la-Cite, the adjoining Conciergerie, an old prison that has seen many tragedies, and the Champs de Mars. In the Champs de Mars is the famous Eiffel Tower, a huge iron structure, 984 feet high, completed for the Paris Exhibition of 1889, and the dominating landmark of the Exhibition held in the heart of Paris in 1937. Besides being used for making scientific observations and as a wireless station, the Eiffel Tower is one of the best places from which to get a view of the city as a whole. The 1937 Paris Exhibition also saw the appearance of a new Trocadero, to replace that built for the Exhibition of 1878. Moreover, the magnificent Musée des Arts is to become a permanent feature of the city. (See page 1579)

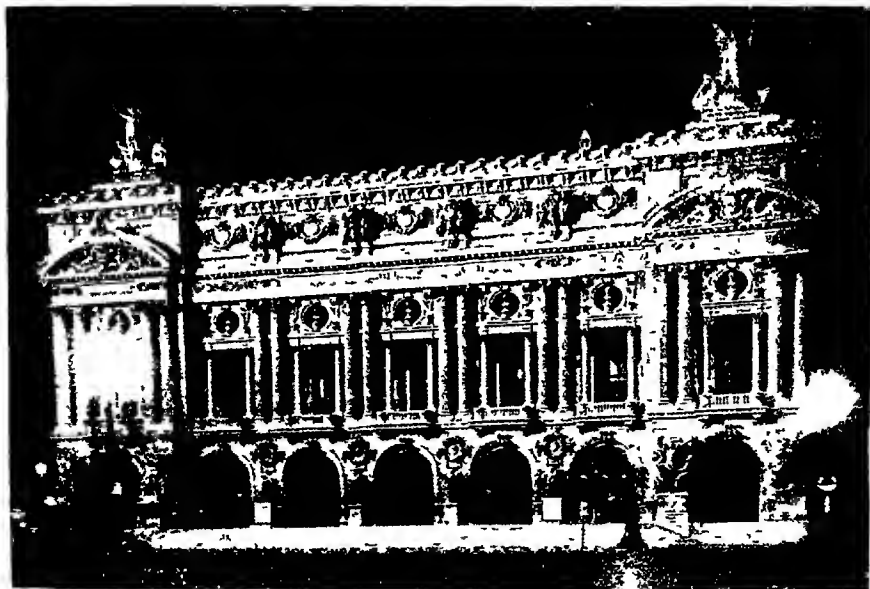
A great number of improvements and additions have recently been made in Paris. The most notable is perhaps the construction of the University City along the Boulevard Jourdan. This is designed to attract students from all over

the world, men and women of almost every nationality are housed in separate buildings under the auspices of their own country.

Much of the business of the city is in luxuries—jewelry, perfumery, expensive gowns and other articles of dress, bronzes, and so forth. Paris being the centre of French finance, important banking and commercial interests are situated here, including the Bank of France. During the World War a number of large factories sprang up on the outskirts of the city, in what are called the "faubourgs" or suburbs. In these factories ammunition, shells, and other munitions were made.

The underground railway, the principal means of transportation in Paris, is named the Métropolitain—usually called the Metro for short. In 1910 the river Seine overflowed and filled the "tubes" with water.

The name "Paris" came from a tribe of early Gauls, called by the Romans *Parisii*, whose mud huts were on the island in the Seine where the cathedral now stands. In the time of Christ Paris was a Roman city named *Lutetia*. In the 4th century it was christened Paris, and in the



PARIS BY NIGHT THE OPERA HOUSE GAY WITH LIGHTS

Erving Galloway

The Paris Opera House, the official title of which is the National Academy of Music, was built to the plans of Charles Garnier and opened in 1875. Originally founded in 1671, the academy of music changed its site many times before it finally became housed in the luxurious building seen above. Opera is given here all the year round, and most of the city's great balls are held here.

10th the counts who ruled it gained the crown of France. From the 12th century the capital was Paris. The kings built many of the beautiful palaces and monuments that made the city what it is, those who did the most for it being Philip Augustus, Louis XI, Henry IV, and Louis XIV.

Under Napoleon Bonaparte, who came to power after the French Revolution (1789-95), many new quays, bridges, streets, squares, markets, and public gardens were created. But, as already mentioned, it was reserved for his nephew Napoleon III to transform Paris into the most splendid and beautiful of modern cities. It was the most amazing example of the remaking of a city that the world up to that time had seen. Unfortunately financial difficulties delayed the completion of the work, and in the dark days of the Commune of 1871, following the downfall of Napoleon III and the march of the vicious Germans through the city, much wanton destruction took place. Many public and private buildings, including the famous Tuileries palace, were burned by the Republicans.

During the war of 1914-18 Paris was bombed by aeroplanes and Zeppelins, and was bombed by the German long-range gun known as "Big Bertha." Though many people were killed and property was damaged, the Germans achieved nothing of military importance.

Paris was scarcely affected by the Second World War until June 3, 1940, when the city was heavily bombed. By June 13 the Germans had tightened their "pincer" movement around the capital. Rather than court the destruction of Paris, the French government declared the city an "open town" and the Allied forces were withdrawn to the south of the capital.

The following day German troops entered Paris and that evening the Swastika was flying from the Eiffel Tower and most of the main

public buildings. Those inhabitants who remained greeted in sullen silence the Nazi soldiery as it marched arrogantly into a city whose spirit it was incapable of comprehending. The population of Paris in 1936 was 2,829,000.

Park, MUNGO (1771-1806) "I shall set sail for Africa with the fixed resolution to discover the termination of the Niger or perish in the attempt though all the Europeans who are with me should die, and though I were myself half dead, I would still persevere, and, if I could not succeed in the object of my journey, I would at least die on the Niger."

This is an extract from a letter which this famous Scottish explorer sent in 1805 to the Colonial Office when he was on the point of starting to explore the unknown part of the river Niger in Africa. In 1795 he had been employed by the African Association to discover the course of the Niger, and had succeeded in tracing it for about 300 miles.

After protesting for a short time as a doctor at Peebles he was commissioned by the Government in 1803 to make a further attempt. This second expedition party, consisting of about forty-five Europeans, started in 1805.

By the time they had arrived at the lower Niger, after travelling about 1,000 miles in a canoe, only

three of the party were left. Near Bussa the boat struck a rock, and the little band of explorers were attacked by hostile natives. Park and his companions jumped into the water and were drowned, with the exception of one native, who survived to tell the tale.

Park's journal of this expedition was never found, but his narrative of the first journey was published in 1799 under the title of "Travels in the Interior of Africa." This book, simply written and packed with adventures, was very popular, and is still regarded as one of the best travel stories ever written.



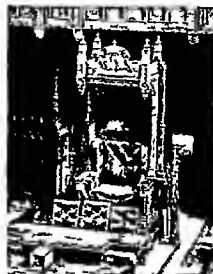
MUNGO PARK'S LAST STAND

The Scottish explorer's last journey ended in disaster. At Bussa rapids, not far below Yendi, on the Niger, his boat stuck fast. He and his companions were attacked by savages, and when their position at last became untenable, they jumped into the river, and all save one native rower were drowned.

PARLIAMENT YESTERDAY and TODAY

Though the "Mother of Parliaments" in England has seen many of her "children" lose favour in various parts of the world, democratic rule seems well established in her own land Our Parliament's history is told here

Parliament. For more than 600 years our Parliament at Westminster has been making laws. It is the oldest legislative assembly in existence, next to the *Althing* of Iceland, and upon it, directly or indirectly, have been modelled most of the legislative bodies in the world. So it is with reason that it is called "the Mother of Parliaments."



The Speaker's Chair

Many of its ceremonies date back to the time of Henry VII and Henry VIII. The beginnings of some of its rules are found in its journals of Elizabeth's reign. Its division into the two houses—House of Lords and House of Commons—took place earlier still, in the middle of the 14th century. Westminster Hall, where some of the earliest Parliaments sat and which is now the vestibule to the Parliament building, is a relic of the palace of King William II, completed in 1097.

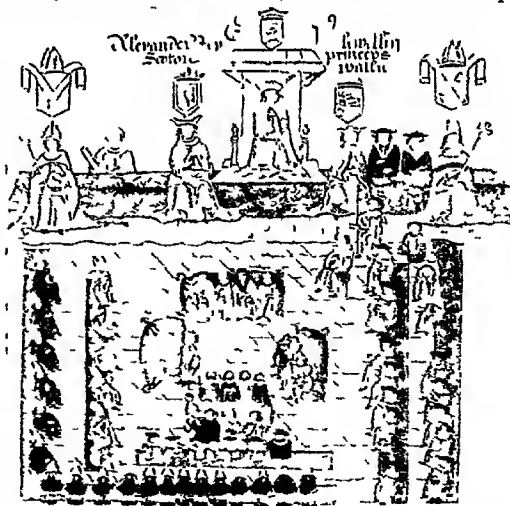
There never has been a time since England was united into a single kingdom when some sort of assembly did not aid the king in governing. In Anglo-Saxon days this body was called the "Witenagemot," or assembly of "wise men," and it was made up of bishops and abbots, king's thanes, and chief officers of the kingdom.

After the Norman Conquest the kings called together their "Great Council," composed of feudal lords who held land directly from the king. These persons all sat in the assembly "in their own right," by virtue of their lands or offices. It was not until the 13th century that elected representatives were added to the assembly, and it is this representative character which chiefly makes the difference between the feudal Great Council and the modern Parliament. By that time, of course, certain rights and liberties of the subject had been defined by Magna Carta (1215) and also the important principle acknowledged that "the king is below the law and not above it."

In 1265, for the first time, in addition to the knights of the shires or counties, representatives of the boroughs or towns were asked to meet with the Great Council. Thus, the first Parliament of the modern type, was called by Simon de Montfort (see Montfort, Simon de) in the time of the barons' wars against the king.

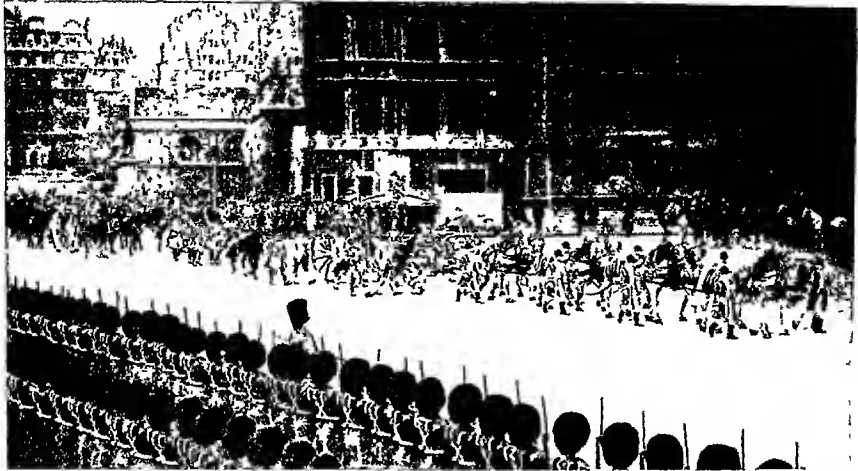
Then, in 1295, Edward I himself called an assembly which established the rule that in the Parliament there ought to be representatives of the counties and the towns along with the lords. This was called the "Model Parliament," because it became a model for succeeding Parliaments in England.

At first the representatives of the counties and towns sat in the same body with the barons and great churchmen, but by the year 1340 Parliament had separated into two "houses." The Upper House became the hereditary House of Lords, and included the great barons (who now bear the titles of Duke, Marquess, Earl, Viscount, and Baron) and also the archbishops



PARLIAMENT OF EDWARD I

The earliest known representation of a sitting of the English Parliament is that reproduced above, which shows Edward I presiding over a session of his Model Parliament. On his left is seated Llewelyn, Prince of North Wales, and on his right Alexander III, King of Scotland.



THE KING DRIVES TO THE STATE OPENING OF PARLIAMENT

The drabness of London life is enlivened from time to time by touches of ceremonial pageantry, and the State Opening of Parliament by the King never fails to draw large crowds of spectators. Above we see the King and Queen driving in their State coach, escorted by Yeomen of the Guard and preceded and followed by a Sovereign's escort of Life Guards. The coach is drawn by eight Windsor greys, ridden by the Royal postillions and accompanied by grooms.

and bishops, and the abbots or heads of monasteries. Since the Reformation the abbots have disappeared from Parliament, and the number of bishops who sit there has been limited.

The Lower House became the elective House of Commons, and in course of time it grew into the most important part of Parliament. This was because it was called upon especially to vote the supplies (moneys) which the king needed for carrying on the government. In time it became an established rule that all bills dealing with money must be introduced in the House of Commons, then the right of the Lords to amend or reject money bills was lost by the Parliament Act of 1911. The House of Commons thus has supreme authority in raising and appropriating money.

For more than a hundred years after the time of Charles II (reigned 1660-85) there was almost no change in the type of constituency represented in the House of Commons, and so grave abuses arose. Many of the members represented what were known as "rotten boroughs," that is, towns which had so declined in population that they were no longer important. Some places which sent representatives in the early 18th century were mere moorlands and ditches, without any inhabitants, or were towns which years before had been swallowed up by the sea.

Sometimes these places were called "pocket boroughs," because the lord of the land practically named the members himself—carried them about "in his pocket," so to speak, and exacted a price for his "patronage." Often such seats in Parliament were openly bought and sold.

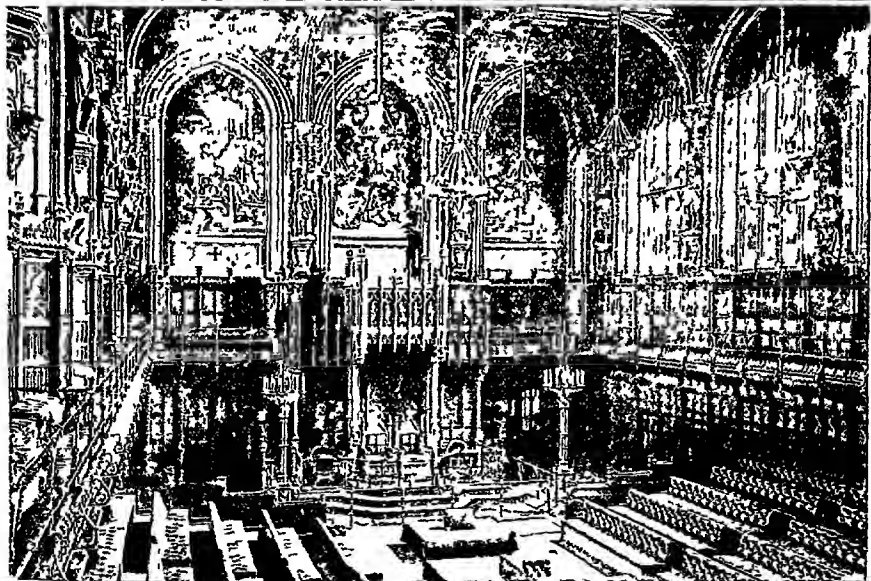
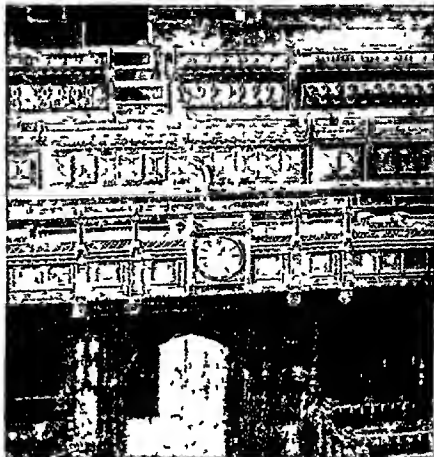
On the other hand, many of the great manufacturing towns, which had sprung up as a result of the Industrial Revolution, had no separate representatives in Parliament apart from the two representatives given to every county or shire. There were also great complaints arising out of the restrictions and inequalities in the right to vote for members of Parliament.

The Great Reform Acts

The first general reform of these abuses was the great Reform Act of 1832. By their provisions many of the small boroughs lost all or part of their representation in Parliament, while the great manufacturing towns gained in representation. At the same time the "franchise," or right to vote, was more liberally interpreted, so that small landholders in the counties secured the vote, and the franchise in the towns was made uniform.

Later laws, passed in 1867 and in 1884-85, further reformed the House of Commons, by giving more people the right to vote and giving representatives to additional towns and districts.

STATELY HOME OF THE MOTHER OF PARLIAMENTS



On either side of the House of Commons are two corridors known as the Division Lobbies, one of which is seen in the photograph, top left. When a division is taken, the "Ayes" pass through the Lobby to the right of the Speaker's chair and the "Noes" through that on the left, both being counted by the tellers as they return to the House. Top right is the Strangers' Gallery, to which spectators are admitted by an order from a member. The lower photograph shows the interior of the House of Lords. Under the canopy are thrones on which the King and Queen sit at the opening of Parliament. In front of the thrones is the "Woolstack" on which the Lord Chancellor sits when presiding over the meetings of the Lords.

Then came female suffrage, and in 1928 a law was passed giving virtually all persons of twenty-one the franchise, so that today the Commons is as representative as any legislative assembly in the world

Reduction in the Lords' Powers

The hereditary House of Lords has also been reformed, and this reformation has meant the loss of its power to stop legislation which the people demand. As stated above, any money bill passed by the House of Commons becomes law without the assent of the House of Lords, but any other bill that is passed by three successive sessions of the House of Commons may become law, even if the House of Lords refuses to pass it. (*See Government*)

In the House of Lords today there are over 700 members, including twenty-eight Irish peers elected by the nobility of Ireland for life, and sixteen Scottish peers elected by the nobles of Scotland for the duration of Parliament. In this House still sit the archbishops of Canterbury and York, twenty-four bishops, and certain "law lords" who are appointed because of their legal ability, and who take part in the work of the House of Lords as a supreme court. The Lord Chancellor usually presides over the Lords' debates.

The House of Commons consists of members representing the counties, the towns, and the universities. There are 615 members in this House, elected for the duration of Parliament, which cannot now be longer than five years, it may, of course, be shorter if the assembly is dissolved by the advice of the Prime Minister. The chief leaders of the party which has a majority in the House of Commons, together with the leaders of that party in the House of Lords, make up the Cabinet, which guides the business of Parliament and at the same time forms the responsible executive of the government.

The Chief Commons' Officers

The Speaker of the House of Commons is elected by the House at the assembling of every new Parliament. His chief function is to preside over debates, maintain the dignity of the House and its traditions against contempt, and to guide procedure. The Serjeant-at-Arms carries the mace on every occasion that the Speaker enters or leaves the House. The Whips are those members of Parliament appointed by their respective parties—the Government and Opposition parties—to "whip up" other members of their own party who may not be in the Chamber for voting at divisions, i.e., on those occasions when the Speaker directs the members to file into separate lobbies on some motion before the House (the "Ayes" to his right, and the "Noes" to his left). This duty of the Whips is very important, especially

for the party in office, as important bills have been known to fail simply through the absence of members who should have been in their places to support it. When a bill is introduced, its first reading is just a matter of form. Before the second reading it must be printed and circulated among the members, and before it can pass to its third reading—three readings are necessary—it may have run the gauntlet of various committees of the House and even been amended out of recognition. It has to pass through the House of Lords and then receive the royal assent before it becomes law.

What are Parliamentary Committees?

Much of the work of Parliament—especially as a groundwork for government measures—is done through committees. The most important of these is a committee of the whole house—in both the Lords and Commons. The House of Commons has six grand committees, and select committees of both houses are frequently appointed to conduct special inquiries, examine witnesses, etc., as a basis for legislation.

Acts of Parliament must be approved by the Crown, which in theory has the right of veto, but as the royal assent has not been withheld from an act of legislation since the time of Queen Anne—more than 200 years ago—no one may say that the right of royal veto has in practice disappeared in Great Britain.

In the hundreds of years that Parliaments have been meeting, some sessions have gained special fame and a special name. There was the Model Parliament of 1295 mentioned above. The Long Parliament summoned by Charles I in 1640 lasted legally until 1660, though during the time of the Protectorate it was not in session. After the army had driven out some of the members of this Parliament in 1648, the remnant was scornfully called the "Rump." In 1653 Oliver Cromwell called together an assembly which his enemies called "Barebone's Parliament," because one of its members was nicknamed Praise-God Barebone. The Cavalier or Drunk Parliament of Charles II, also called the Long Parliament of the Restoration, lasted from 1661 to 1679.

One Parliament for Three Countries

Scotland ceased to have a Parliament of its own and began sending members to the Parliament at Westminster when Scotland was joined with England, in 1707, in the kingdom of Great Britain.

Ireland had its separate Parliament until 1801, when it, too, was merged in the Parliament of Great Britain. The Home Rule movement, to which Charles Stewart Parnell gave his life, sought to restore the Irish Parliament. The battle having been won, the Irish Free State now has its own legislature, whilst the north of Ireland is governed by the Parliament



THE HOUSE OF COMMONS IN SESSION

THE PRIME MINISTER AND HIS ASSOCIATES IN THE GOVERNMENT SIT ON THE FRONT BENCHES AT THE SPEAKER'S RIGHT. MEMBERS WHO WISH TO ADDRESS THE HOUSE RISE IN THEIR PLACES, AND WAIT FOR RECOGNITION FROM THE SPEAKER. MEMBERS WHO RISE TO SPEAK MUST REMOVE THEIR HATS, BUT OTHERWISE THEY MAY KEEP THEIR HEADS COVERED IF THEY WISH. BECAUSE THE MINISTERS ARE BUSY MOST OF THE DAY WITH THE AFFAIRS OF THEIR DEPARTMENTS, THE IMPORTANT SESSIONS OF THE HOUSE ARE USUALLY AT NIGHT, AND OFTEN CONTINUE FAR INTO THE MORNING.

of Northern Ireland (See articles on Ireland, Ireland, Northern, and Irish Free State)

Parliament has full legislative authority throughout the Empire, subject to the self governing powers of the Dominions, which were affirmed by the Statute of Westminster (1931). An Imperial conference of the Prime Ministers and other Ministers of the Parliaments of the Empire is now a regular practice to consider matters of mutual interest such as defence and inter Empire trade.

Parnell, CHARLES STEWART (1846-1891)
Years ago, before the Irish Free State was born, Ireland was a constant thorn in the side of Britain. The majority of her people wanted, if not complete independence, at least Home Rule, and for a hundred years, right up to 1921, there was a bitter struggle between the two nations. The greatest leader of the fight on the Irish side was Charles Stewart Parnell, who was long practically "uncrowned king" of Ireland.

Parnell received his education at Cambridge and entered Parliament as a Home Ruler in 1875, representing Meath. The organized Home Rule movement was then very young. The grievances of the Irish peasantry against the exactions and evictions of the landlords, many

of them English, were then at their height. The Prime Minister, Mr Gladstone, tried in 1870 to ease their plight by a Land Act, but this was small relief. After succeeding Isaac Butt as leader of the Irish Party in 1880, Parnell determined to make the "agrarian question" the basis and motive power of his campaign and, with the support of the Femans—the extremist elements who actually demanded absolute separation of Ireland from Britain—started on a policy of obstruction in Parliament which thoroughly disorganized its proceedings and finally brought him close to realizing his aim.

In 1879 the National Land League of Ireland was formed with Parnell as President to bring about a reduction of rents and to secure ownership of their lands for the tenants. At about the same time he organized a "boycott" movement which landed him in gaol. Then, shortly before his release, followed the "Kilmainham Treaty" with Gladstone by which he agreed that the "pay no rent" order which he had issued from prison would be withdrawn on condition that the government dealt sympathetically with the question of arrears.

The future was promising, but in 1882 occurred the murder, in Phoenix Park, Dublin, of



CHARLES STEWART PARNELL

Parnell was the leader of the Irish nationalists, who brought the question of Home Rule into practical politics. He is seen in this drawing by Sydney P. Hall facing his accusers during a sitting of the commission appointed to investigate charges in connexion with the Phoenix Park outrages.

National Portrait Gallery

the Chief Secretary for Ireland and the Under-Secretary. This crime by the Irish extremists for some years blasted Irish hopes, and it nearly led to Parnell's retirement from public life. His health, too, was already very bad from overwork. The failure of Gladstone's Home Rule Bill in 1886 can be traced to this murder.

Then came the publication in "The Times" of a letter, supposed to be in Parnell's hand, in which he excused the Phoenix Park murders. Parnell maintained his innocence of this and other charges and invited Gladstone to set up a commission of inquiry. This was done.

It was a most remarkable state trial, and Parnell was completely exonerated. "The Times," it turned out, had bought the letters from one Richard Pigott. Pigott broke down in court under cross-examination, and, before another sitting, blew his brains out after having confessed to his guilt. Parnell's prestige rose very high in both Ireland and England.

On the other hand, a divorce case a few years later led to Parnell's fall. Captain O'Shea had

been one of Parnell's confidential lieutenants. It was about 1881 that Parnell became very friendly with Mrs. O'Shea. Why Captain O'Shea waited till 1889 before he filed his petition, it is difficult to explain. Parnell, aloof and disinclined to offer evidence on a matter he considered to belong to his personal life, did not contest the suit and the divorce was granted. A year afterwards he married Mrs. O'Shea.

However, much his followers wished to stand by Parnell in this scandal, the Home Rule movement was at stake. Gladstone, most favourable of British statesmen to Irish demands, asked him to resign as leader of the Irish Party, otherwise he could not guarantee the support of his Nonconformist followers who were aghast at the scandal. This Parnell refused to do, but his followers deserted him and he resigned his leadership. After some bitter campaigning in Ireland, the great leader died at Brighton.

Parrots, Macaws, and Cockatoos. Including the macaws and cockatoos with the parrots, to whom they are closely related, there are over 500 species of these gorgeous birds, all members of the order *Psittaci*. They inhabit South America, Africa, the East Indies, Australia, and New Zealand. All are characterized by the large, arched upper beak and by this position of the toes, two of which point forward and two backward.

These birds all have a harsh screaming voice, but many have the power of imitation and can be taught to speak a limited number of words.

Parrots are clumsy walkers, but good climbers and strong fliers. The birds mate for life, and nest in hollow trees or occasionally in sand-harsh. Parrots, especially, endure cage life well, and in spite of their habit of biting are favourite pets. Fruit, nuts, and seeds are their chief food. They are long-lived, some reaching the age of seventy years or more. The grey parrot of western Africa is the species most easily taught to speak.

The macaws are the most gorgeously coloured members of the group, you will find them under their own heading. (See also Colour Plate facing page 2597).

The cockatoos, found mostly in Australasia, are similar to the parrots in habit. They thrive well in captivity and may be taught a few words, but are more apt to use their voices in screaming. The plumage of the cockatoo is generally white tinged with red, orange, and other colours.

PARROTS

Most species have a large crest of feathers that can be raised to a height of 5 inches.

The lory is a species of parrot remarkable for its peculiar extensible tongue, with which it takes the nectar of flowers. In New Zealand occurs the kea, an olive-green bird of parrot type which, originally a fruit eater, is said to attack sheep, thrusting its powerful beak into the fat which surrounds the kidneys.

Love birds, or budgerigars, are tiny African parrots, no larger than sparrows. They receive their first name from the affection a pair of them will show to each other.

In 1929 there was an outbreak of psittacosis, a disease of parrots transmissible to Man, and the importation of parrots was prohibited in Great Britain.

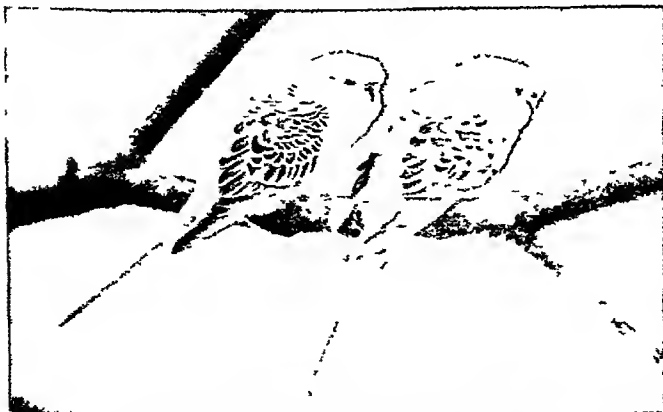
Parsnip. The parsnip (*Pastinaca sativa*) provides an example of a hardy biennial plant—that is, it forms its fleshy carrot shaped root the first year, but does not produce any seed until the second summer, then the plant, springing up quickly from the root, sends a branching stem up among the leaves, topped with many greenish-white little flowers. The root, which is in fact a storage organ for this second year's growth, is eaten the first season. It is thick and whitish and has a peculiar but agreeable flavour, sweet but slightly acid. The root often grows to a length of 18 inches and a diameter of 3 or 4 inches at the crown. Besides being cultivated as a vegetable the parsnip is highly valued as a food for live stock, particularly in Europe. The roots are

PARTRIDGE

usually left in the ground in the autumn, as they are improved by the frost, when stored they soon become tough unless kept moist.

In Europe the plant has been cultivated since the time of the Romans. A wild form of parsnip without the thickened edible root still grows as a troublesome weed in waste places of Europe, the United States, and Canada.

Partridge. This game bird is a near relative of the pheasant and grouse. We have in England two species—the common one, and the French or red-legged, which is an introduced species. The common partridge is



TWO KINDS OF PET PARROTS

Probably no cage bird is so popular as the parrot, and the grey species (upper photograph) may be a most amusing and talkative pet. The little love birds, or budgerigars in the lower picture, have recently also become favourites, for they are as pretty as they are affectionate.

Illustration by Fred. A.

recognizable by the bright chestnut horseshoe marking on the breast, which is otherwise greyish, the rest of its plumage is brownish, except for the head, which is also chestnut. When sitting with its body pressed close to the ground, this bird is almost invisible.

The French partridge, perhaps because the countryside in its native land is of a rather different type, is paler in colour and thus easier to see. There are dark markings on the head and breast, forming more or less a ring round

PARTRIDGE

the white throat Yet, in spite of this, the French sort has in many parts ousted our native bird

Partridge-shooting is especially popular in East Anglia, where the vast fields of "roots" are ideally suited to the breeding of this bird. In many cases partridges are shot by "walking up" with dogs rather than by an organized series of drives as with grouse and pheasants. These birds also afford good sport in parts of the Highland and the Hebrides where there is



MOTHER PARTRIDGE AND HER FAMILY

This photo required a great deal of care and patience, for not only is the partridge very shy, but also the young are led away from the nest only an hour or two after they have hatched. They are able to run about from birth

not enough heather for grouse, nor cover for pheasants, for partridges are fond of sand and an open type of country

Passover. With tears and rejoicing, with song and praise, the Jews through many centuries have celebrated the festival of freedom, which commemorates their deliverance from Egypt. Round the festal board on the eve of the Passover the family gather to rejoice and thank God for His preservation of their race.

The father of the family sits at the head of the table, which is spread with the best linen and adorned with the best of the family plate. Before him are symbols such as have been used since ancient times to explain the story of the Passover. First of all, there are three flat loaves of *mazzoth*, or unleavened bread. This is a reminder of the haste with which the Israelites were forced to leave Egypt; they had no time to make provision for the journey or to allow their bread to rise, but had to carry the unleavened dough with them and bake it on the way.

A roasted lamb bone and a roasted egg commemorate the burnt offering which the

Hebrews were commanded to offer, when God promised to pass over their houses and spare their first-born. Another dish contains a portion of horse-radish or other bitter herb, used to represent the bitter life of the Israelites in Egypt, and a paste of nuts, apples, and spices made to resemble clay or mortar, is a sign of the heavy toil exacted by the Egyptians.

These symbolical dishes are tasted at stated times, while the father reads from the Talmud (civil and religious law) legends of the forefathers, miraculous stories, prayers, and songs, in which the rest of the family often join.

The Jewish Passover falls in the early spring, about the same time as the Christian Easter. The Last Supper of Christ and His disciples was the opening feast of the Passover. The date of the Passover is not determined in the same way as that of Easter, however, hence they do not always come together. Passover begins on the 14th of the Jewish month of Nisan, and lasts till the 21st. Only unleavened bread is eaten during the week, and the first and last days are kept as holy days. The Orthodox Jews keep eight days instead of seven, observing the first two and the last two days as holy days.

Passport. All persons travelling in foreign countries must carry a passport, the only exceptions being for certain specified short excursions.

A British Foreign Office passport is a document issued by the Passport Office under the authority of the Foreign Secretary, certifying to a person's citizenship and asking the governments of the countries for which it is valid to give him or her all lawful aid and protection. Even in the very few countries that do not require a passport for admission, a passport is useful as evidence of nationality.

A passport is available in the first instance for five years, and may be renewed up to a total period of ten years from the date of issue. It may include particulars of the holder's wife and of his children, if under 16 years of age. A British passport is available for travel only to the countries named thereon, but endorsements may be made as required. Some countries, it should be noted, require a special "visa" issued by their representative on the passport. The word comes from the French *passer*, "to pass," and *port*, a "port" or "harbour."

Pasteur, Louis (Pron pah-têr') (1822-1895) On the afternoon of July 2, 1881, a group composed of French officials, eminent scientists, delegates from medical societies, Parisian journalists, and a scattering of farmers waited

LOUIS PASTEUR AT WORK IN HIS LABORATORY



"There is no greater charm for the investigator," said Louis Pasteur "than to make new discoveries, but his pleasure is heightened when he sees that they have a direct application to practical life." Pasteur lived to see the results of many of his own discoveries spread over the world, changing the whole history of biological science completely transforming the practice of medicine, and best of all, bringing relief from suffering

and greater security from untimely death to countless thousands of people. No Frenchman's name is more sincerely honoured than that of this modest chemist whose combined genius and patience made these results possible. We see him here in his small laboratory working with the simple apparatus he used to demonstrate that germs were never "spontaneously generated" but appeared only as the result of "infection" from existing germs

expectantly in a farm-yard in the little village of Pouilly-le-Fort. A few members of the party were inspecting a row of dead sheep which occupied one side of the enclosure. The others watched the roadway. Presently one of these called out "Here he comes!" and the entire group broke into a loud cheer as a small bearded man appeared in the gateway. He bowed, then advanced toward the sheep carcasses. He counted them—there were twenty-five.

"Where are the others?" he asked quickly.

Someone pointed to a pen filled with living sheep. The bearded man counted again—twenty-five. Then he turned to the assemblage with a simple gesture and said "You see, gentlemen."

It was a moment of triumph for one of the greatest of men—Louis Pasteur, world-famous chemist. Some months before he had announced that sheep and cattle could be protected from the deadly disease of anthrax—the germ of which was discovered by Koch five years before—by first injecting into their blood some of the weakened germs of the disease itself. The bodies of these animals, he said, would in this way develop such a power of immunity against anthrax that its germ could obtain no hold upon them.

His statement met with ridicule, and proof was demanded. Pasteur accepted the challenge. Fifty sheep were placed at his disposal. He vaccinated twenty-five of them, the others were left in their natural state. Some days later the entire fifty were inoculated with powerful cultures of living anthrax germs.

"The twenty-five vaccinated sheep will live," said Pasteur, "the others will die."

We have seen the result of the experiment. This was only one of his many great achievements. He extended the method he had used in anthrax to the terrifying disease of rabies, or hydrophobia. He succeeded in making animals immune against rabies germs, and

finally saved the life of a boy who had been bitten by a mad dog, and who was the first person that ever escaped death under such circumstances. It was owing to Pasteur's discoveries of the effects of bacteria in fermentation and decay that Lord Lister was able to devise the methods of antiseptic surgery.

Pasteur also discovered and overcame the germ which was killing the silkworms of France and threatening the entire silk industry. He

devised the method of preserving the purity of milk called "pasteurization." His work laid the foundation for most of the great life-saving discoveries of the last 50 years in the field of germ diseases.

Pasteur was born at Dôle, in the district of Franche Comte, where his father was a tanner. After many struggles he entered the Ecole Normale in Paris. Strangely enough, the graduating diploma of the boy who was to become the greatest chemist of his time was marked "mediocre" in chemistry, perhaps because Pasteur's school work was already distinguished by that independence and originality which contributed so much to his later success. His gospel was the "will to work," and he was never satisfied with tasks half done. In 1858 he was appointed professor of chemistry at the Sorbonne, and in 1888 he became director



PATAGONIAN INDIANS

The original natives of Patagonia belonged to two races, the Tehuelches and the Gennakens, but the latter are now almost extinct. Above is a typical Tehuelche Indian with her daughter. They love bright colours and show great skill in weaving them into their hand-made garments.
Photo: Field Museum of Natural History, Chicago

of the famous centre of scientific research known today as the Pasteur Institute. The esteem in which Pasteur was, and is, held by his countrymen is shown by the number of French postage stamps bearing his portrait which have appeared.

Patagonia. The southern part of the continent of South America, as far as the Straits of Magellan which separate it from the archipelago of Tierra del Fuego, has long been known as Patagonia. Since 1881 the land has been divided between Chile and Argentina. The Chilean section, to the west of the Andes, is a densely wooded strip only a few miles wide. The Argentine section, extending 1,000 miles

north to the Rio Negro, is a tract of more than 300,000 square miles, nearly one third of the area of the whole Argentine republic. Patagonia was discovered in 1520 by Ferdinand Magellan. It was then inhabited by a race of Indians remarkable for their great stature, but this race is today virtually extinct (*See Argentina, Chile*).

Patents. Every year over 30,000 patents are applied for in Great Britain alone, and yet only about half this number are granted. All inventions submitted to the Patent Office are carefully examined by specially qualified experts, in order to assess their usefulness, and

records of inventions for the past fifty years are searched, to make certain that the ideas are really new. It is on these two points that the vast majority of inventors tip up—either their inventions are not really original, or else they make no real improvement on existing inventions. However, if an invention is found to be sufficiently meritorious and genuinely original, a patent is granted on payment of a fee.

A patent entitles the inventor to the exclusive control of the manufacture and marketing of his invention for a period of sixteen years. This privilege is granted because experience has shown that no reward is so fitted to the achievements of inventors (and at the same time so productive of common welfare) as allowing them a monopoly of their inventions for a limited time. At the end of that time the inventor must give up this right, so that the public may derive full benefit from the invention. If anyone infringes the rights of an inventor—that is, makes or sells his patented article without permission—he can compel the offender to stop doing so and to make reparation.

If, at the end of sixteen years, the inventor claims that he has not been sufficiently rewarded for his invention, he may apply for an extension of a further seven years. Every patented article must be marked "Patented" with the date of issue, or patent number.

Perhaps the most hopeless type of invention to submit to the Patent Office is one that claims

to have solved the problem of perpetual motion (*see Energy*), for, though no patent has ever been granted for this, year after year hundreds of inventors waste their valuable time trying, in vain, to solve what scientists know to be an impossibility. One of the most important and most elementary scientific principles is that energy cannot be created or destroyed, and unless we can create energy, as it were, out of nothing, we cannot obtain perpetual motion.

The owner of a patent may allow others to make use of, or adopt, his invention under a special licence. In this case the owner of the

licence must make a payment—known as a *royalty*—for each article manufactured. The term "royalty" is also applied to the sum paid by a publisher to an author for each copy of the author's book that he sells (*See article on Copyright*).

By international agreement among all the principal countries the citizens of each country enjoy in the others the same patent rights as those countries give to their own citizens. During war, however, the patents of citizens of enemy countries may be seized like other property.

Patrick, SAINT (d. 461 or 493). We all know March 17, when St. Patrick's Day, the day of the patron saint of Ireland, is celebrated. But

nobody knows for certain where he was born. Some say in Scotland at Kilpatrick, a district immediately outside Dumbarton, where the young saint attended the flocks as a herd-boy, others think he was a native of England or of Wales. He lived in the troubled days when the Romans were abandoning Britain to its fate, and before the English had appeared, and was educated as a Christian. Then, one day, when he was sixteen years old, some Irish raiders took him as a slave, carrying him away to Ireland.

After he had served in Ireland for six years as a swineherd, he escaped to Gaul. For a time he lived in Gaul, where he became a monk, and then returned to his home in Britain.

After his return he dreamed one night that a man came to him with a paper bearing these



ST. PATRICK, IRELAND'S PATRON SAINT
On the hill at Tara, where he used to preach, stands this statue of St. Patrick. It marks the place where the Stone of Destiny is said to have stood before it was removed to Stone and thence to Westminster Abbey, where it is used as the Coronation Stone.

PATRICK

words, "The Voice of the Irish," and at the same time he heard the Irish calling, "We pray thee, holy youth, to come and walk again amongst us as before"

This visionary message, Patrick decided, was a missionary call to Ireland. He returned to Gaul, where he spent fourteen years in preparing for his work. He arrived in Ireland with the title of bishop and the Pope's blessing, and began the work which was to make him the patron saint of the island.

It has been said that there "were no Christians in Ireland when Patrick began his work and no pagans when he died." This is not strictly true, but he did establish Christianity firmly in the island, building churches and monasteries and converting the people. And he did this work while fierce tribal chieftains ruled the land.

Many legends grew up in Ireland about St. Patrick. You know, perhaps, the story of how he compelled the snakes of Ireland to fling themselves into the sea. There is another story to

PAUL

the effect that when some converts questioned the doctrine of the Trinity, St. Patrick ended the argument by holding up a shamrock leaf, to show that the Trinity of the Godhead, Three in One, was not unacceptable to human belief.

Paul, SAINT (A.D. 3?-67?) Saul of Tarsus, fiery persecutor of the early followers of Jesus, was one day going down the road to Damascus to take prisoner all the Christians he could find there. Suddenly, according to the account in Acts ix, a great blinding light shone down on him, and a voice said, "Saul, Saul, why persecutest thou Me?" Trembling, Saul asked, "Who art Thou, Lord?" and the voice answered, "I am Jesus whom thou persecutest." Saul, shaken and still blinded, proceeded to Damascus, a follower of the Man whose disciples he had started out to imprison, and "straight way he preached Christ in the synagogues, that He is the Son of God."

With such a great change in his convictions it is not strange that the Pharisees, the strict



ST. PAUL PREACHING TO THE GENTILES AT ATHENS

When St. Paul came to Athens, "his spirit was stirred in him when he saw the city wholly given to idolatry. Therefore disputed he in the synagogue with the Jews, and with the devout persons, and in the market daily with them that met with him" (Acts xvii, 16). This tapestry at the Vatican, designed by Raphael, shows St. Paul preaching in Athens.

Photo Anderson

Jewish sect to which he belonged, thought him mad, and the followers of Jesus believed he was a spy.

So he left Jerusalem and went to his old home, Tarsus, spending three years chiefly in meditation and retirement. Then he took up his mission and went to many other towns in Asia Minor and Greece, establishing churches and gaining many converts to Christ.

Saul later known as Paul, was a Roman citizen, the son of parents who were prominent Hebrews of Tarsus. The boy was educated under the most distinguished rabbis of the day at Jerusalem, where he was carefully trained in the strict faith and in the traditions of the Jews. All of the boys of his nationality learned some trade, and Saul was taught to make tents, and later, on his preaching tours in various cities, supported himself by tent-making.

He was made a member of the Council of Jerusalem while yet a young man. With his strict training it is no wonder that when Jesus called the Pharisees wolves in sheep's clothing, and said that the strict rules they observed would not save them, Saul was shocked and angry.

The First Great Missionary

After his conversion, which occurred when he was about 32, he visited Peter to learn of the life of Jesus, Whom, it is believed, he never saw during his lifetime. Then he started out on his great missionary travels. His method was always the same. First he spoke in the synagogue, and when the Jews became hostile he would withdraw and organize a church of the Gentile Christian order. This aroused the conservative element of the early Christians, who did not agree with Paul that it was possible for a man to be a Christian without first going through certain Jewish ceremonies.

It was Saul or Paul, as he preferred to call himself after his conversion, who first conceived of Christianity as a world-wide religion, and who formulated the theology of the Christian Church, for his logical mind and training in the law made him supreme in definition and controversy.

He so antagonized the Jews that when he returned to Jerusalem he was seized and thrown into prison, where he was kept two years. Finally he availed himself of his right as a Roman citizen and appealed to the Emperor Agrippa. He was sent to Rome and held there, a virtual prisoner for two years more. According to tradition he was beheaded.



R. A. Yellow
POPULAR SWEET PEA

This lovely hardy annual is a great favourite for cutting and some of the modern varieties can be obtained in a profusion of delicate colours. Above is a four-bloom stem of a frilled variety.

The Epistles of Paul, which form a considerable part of the New Testament, are letters he wrote to his friends and to the various churches. Many of them were written while he was in prison. The Acts of the Apostles tells of his work.

Pea. Fine, fresh, tender peas are a delicacy for the table of the most fastidious, yet from time immemorial peas have been the protein food of the poor.

For the cheapest form in which the necessary protein foods can be obtained is in peas or some other member of their group.

The most remarkable thing about peas and the whole group of plants to which they belong is their unique ability to produce a nitrogenous food for Man and beast, and at the same time enrich the soil in which they grow by the formation of nitrogen compounds. (See Nitrogen).

A very obvious difference between the garden pea (*Pisum sativum*) and its cousin the bean is the pea's tendrils, borne instead of a terminal leaflet on the leaf.

Garden peas are eaten green and fresh, and they are also preserved in immense quantities, either by bottling or by canning, for use at seasons of the year when fresh peas are not available in the shops.

The coarser, blue flowered field peas (*Pisum arvense*) are grown for stock food, both plant and fruit being used as silage. The seeds are also used dry and ground with stock-food mashers, and form the "split pea." Sweet peas are an ornamental species developed for the blossoms. Peas are the chief plants of the order *Leguminosae*, to which also belong the beans, vetches, clovers, and gorse, to name a few types. All have the "butterfly shaped" flower with five unequal petals.

Peabody, GEORGE (1795-1869) Though he amassed one of the great fortunes of his time, George Peabody, banker and merchant, is remembered not for his gains but for his gifts. He poured out nearly £2,000,000 in benefactions in his native United States and his adopted country, England, and was held in high honour by both nations. He was offered, but declined, a baronetcy by Queen Victoria, and in 1900 his name was inscribed among the other great names in the American Hall of Fame.

He gave £500,000 to provide houses in London for the working classes, in addition to other charities, but his chief philanthropy was in the

interest of education After the American Civil War he gave to the war-torn, impoverished Southern states £700,000 to help bankrupt cities and towns to build and run schools To Danvers, Massachusetts, the town where Peabody was born, and where he started clerking in a grocery store when 11 years old, he gave a public library and institute To Baltimore, where his wholesale drapery business began the fortune he increased in England, he gave a large sum to endow another institute

He died in London Nov 4, 1869 and, after lying in state in Westminster Abbey, his body was carried to America in a British warship, and buried in the town of his birth His chief monuments are the Peabody Buildings which stand in many of the poorer districts of London and are the homes of thousands of working-class people

Peace Movement. War has always brought sorrow and suffering, but its effects have become ever more terrible with the advance of civilization Moreover, the instruments of destruction have grown so powerful that a great war has become a world disaster The appalling costs in lives and property of the World War of 1914-1918, and the heavy economic burdens and severe suffering it left in its wake, led large groups of people in every country to feel that war must be abolished

For centuries a few persons in various countries have worked to bring about world peace, but the modern peace movement is a product of the period since the French Revolution In 1843 the first international peace congress was held in London By 1914 there were in the world 160 peace societies, with many branches and an enormous membership

The Fight Against the War Mind

Serious difficulties confronted the advocates of peace The causes of war were manifold Nations with large and growing populations often went to war to gain territory Others, developing commercially, went to war to gain colonies where they could buy and sell freely Some nations went to war to free blood kinsmen from foreign rule, to gain a sure outlet to the sea, or to win for themselves some disputed strip of territory

Fear undoubtedly played an important part When one nation saw a neighbouring state growing stronger it feared for its own security It increased its armaments and perhaps sought allies Suspicion and distrust followed, and a trivial incident might start a great international conflict Finally, perhaps the most important single cause of war has been the emphasis which nations placed on their right to do as they pleased They insisted on their sovereignty and refused to abandon any portion of their independence to the judgement or

decision of their fellows They insisted that they were free to fight or to arbitrate, just as they desired Peace advocates call this condition "international anarchy"

Persons interested in the peace movement have two outstanding aims to bring about settlement of international disputes by arbitration, and to bring about limitation and reduction of national armaments (See Arbitration)

First Steps in Outlawing War

An organized international movement on behalf of arbitration did not begin until the close of the 19th century, although nations had voluntarily tried arbitration earlier The effort made at The Hague Conferences of 1899 and 1907 to provide for compulsory arbitration failed As a result resort to the Permanent Court of International Arbitration was made not compulsory, but voluntary

At the close of the World War the Versailles Peace Conference drafted the Covenant of the League of Nations This was later signed by about 60 nations, which thereby agreed to submit their differences to some form of mediation or arbitration before they resorted to war The League of Nations, in turn, established in 1921 the Permanent Court of International Justice for the purpose of settling international disputes which arose over legal questions (See League of Nations)

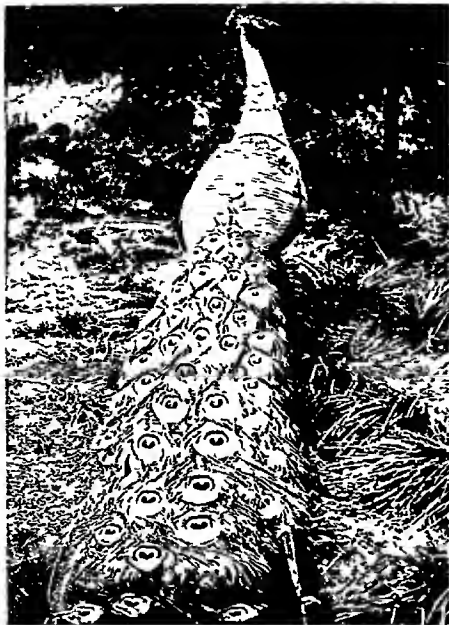
Locarno and Kellogg Pacts

The Locarno Conference of 1925 was an attempt to supplement the Versailles Treaty Finally, in 1928-29, most of the Great Powers signed the Peace Pact of Paris (usually known as the Kellogg Pact), by which they agreed to outlaw war as an instrument of national policy and to endeavour to obtain pacific settlement of all international disputes

So far, the movement towards the reduction of armaments has produced small result A beginning of the compulsory limitation of armaments was made in 1919 at the Peace Conference Germany, Austria, Hungary, and Bulgaria were compelled to agree to observe the military and naval limitations placed upon them by the peace treaties These limitations, the Allied statesmen at Paris announced, were the first step towards "the initiation of a general limitation of armaments of all nations" After ten years of preparation, a Disarmament Conference met at Geneva in 1932, but after much fruitless discussion it ended in failure

Reducing Naval Armaments

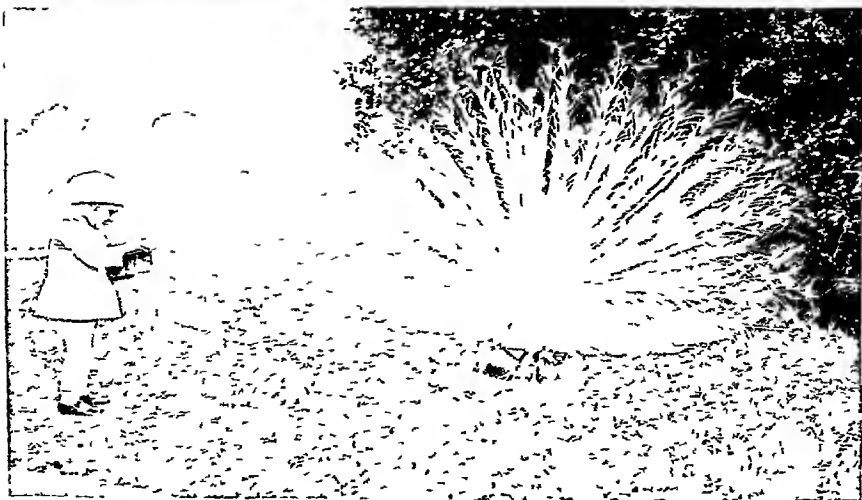
Naval limitation had for a time proved more successful At the Washington Conference called by President Harding a "naval holiday" was agreed upon in 1922 by Great Britain, the United States, Japan, France, and Italy, but the London Conference of 1936 resulted in a treaty, signed by Great Britain, France, and the United



PEACOCK'S FINE FEATHERS

THE most noticeable feature of the closed 'tail' of the peacock is its enormous 'eyes' and the ancients remarked this as well for to them the peacock represented Argus, the hundred eyed mythical character employed by Hera to watch over Io. According to the story Zeus had him killed, and Hera transplanted his eyes to the peacock's tail. These 'eyes' owe their wonderful colours to the arrangement of the barbules of the feathers themselves, combined with a certain amount of pigment. When the pigment is absent, an albino peacock results, like the bird seen below. Its white plumes are in their way no less lovely than those of the normal form, and certainly unusual enough to make a photograph of the bird well worth taking.

For Photos



GLORIOUS DISPLAY OF THE PEACOCK'S PLUMAGE



The magnificent colours of the peacock's plumage have made their wearer justly famous, but we should be careful, if we want to be strictly accurate, not to refer to these fine feathers as his tail. The tail itself is quite an ordinary affair, whereas these glorious plumes are part of the tail-coverts, the feathers on the back at the base of the tail. They owe their iridescence not to pigments but to refraction caused by the structural arrangement of the parts of the feathers, as is the case in all metallic-tinted plumage.

States which put no limits on the size of navies. A new race in naval building began, side by side with the expansion of armies and air forces all over the world. (See Navy)

A more hopeful example of international co-operation was in the New World, where the Pan-American Union, founded in 1890, helped to promote peace and goodwill among the republics of North and South America. Note worthy also in this connexion is the harmony between Canada and the United States.

While nations failed in attempts to guarantee peace by pacts and treaties, groups within most nations continued their attempts to promote international goodwill. These groups emphasized a realistic study of the causes and cures of war, and sought to build up international goodwill and understanding.

The League of Nations Union, allied to the International Peace Campaign, seeks to "mobilize and render effective public opinion in all countries in support of Peace, Disarmament, and International Justice through a strong League of Nations." As a member of the latter, Britain based much of her foreign policy on "collective security" among the nations.

Great public interest was aroused by the nation-wide "Peace Ballot" organized by the League of Nations Union in 1935. The majority of those who voted approved of Britain being a member of the League, favoured disarmament, saw no justification in abolishing military aircraft, wanted to prohibit private arms manufacture, and believed in economic and military "sanctions" against an aggressor nation.

A World Peace Congress was held at Brussels in 1936, with 5,000 delegates representing not only organizations like the League of Nations Union, National Peace Council, Peace Pledge Union, and International Peace Society, but also the Churches, trade unions, ex-servicemen, youth movements, and so forth.

Later, the activities of munitions makers in peace and war came in for considerable discussion. It was revealed that many firms sell arms

to both sides in time of war, start war scares, and discourage disarmament efforts, to help to sell their goods. Some countries have tried to nationalize or control the munitions industry.

Peach. You might not guess that the peach (*Prunus persica*) and almond were first cousins, and yet this is probably the case. Indeed, one variety of peach still has an edible almond-flavoured kernel within its hard stone. Nowhere has the peach been found wild, and it has evidently been cultivated from time immemorial.

Popularly, peaches are classed either as "freestones" or "clings." The nectarine is a smooth waxy-skinned variety with a firmer and more aromatic pulp.

The peach is a delicate plant, and has the unfortunate habit of blossoming early, thus suffering from the effects of late frosts. It can best be grown, therefore, where frosts do not come or where cold springs delay the buds until the danger of frost is past.

Commercially, the fruit ranks very high, but because it is so perishable it scarcely entered into commerce until fast trains and refrigeration made it possible to market it quickly.

Many of the best peaches cannot be marketed except near the place where they are

grown. The facts that the peach is difficult to grow, must be picked as soon as it is ripe but before it is soft, and cannot be kept more than ten days or two weeks at most, make it a luxury as a fresh fruit. In England peaches are commonly grown under glass or trained on sunny walls. Most of the tinned peaches are grown in California.

The peach belongs to the same genus as the plum, apricot, and cherry. It is a small tree from 10 to 20 feet high, and bears many branches, the fragrant pink blossoms usually appearing before the leaves.

Peacock. The saying "as proud as a peacock" does no injustice to the handsome male of this species, which belongs to the pheasant family. His gorgeous plumage combines the metallic shades of bronze, blue, green, and gold,



Fox Photos

PEACHES IN THE SUSSEX SUN

Most of the tinned peaches we eat come from California, but dessert peaches, largely destined for Covent Garden market, are grown under glass in the south of England. Here we see a fine crop of luscious peaches grown at Lancing in Sussex.



PROUD PEACOCK WITH HIS GLORIOUS TRAIN

Although not a native of Britain the peacock is better known than many of our own birds, so famous is its magnificent 'tail'—here seen folded up. It is common in public parks and in the gardens of large country houses. This individual is in all the finery of his new spring plumage.

and a crest adorns his head. But his chief glory is the long train of brilliantly marked plumes which grow just above the tail feathers

and a distinction awarded to mandarins for conspicuous public services.

These birds have long been the symbol of splendour and pride. The famous peacock throne of the Mogul emperors at Delhi was of unparalleled magnificence, for it had as its background the figure of a peacock with expanded train wrought all in gold and precious stones and gems.

The Japanese peacock has upper wing coverts of deep lustrous blue, from which the colour term "peacock blue" has arisen. The hen of this species is a grizzled white. Occasionally all white albino individuals of the common sort are seen.

Peafowls (*Pavo cristatus*) are natives of India and Ceylon, where they are common in a wild state. One cock and three or four hens usually constitute a flock. The nest is a rude affair on the ground, or on low branches, and contains about six eggs. Male and female of the young birds are feathered alike until about two years old, then the tail coverts of the male begin to develop their brilliant colours. The note of the peacock is a weird, unearthly scream.



LUSCIOUS SPRAY OF PEARS

Many people hold that a good pear is the most delicious of all fruits, and these fine examples, hanging on the tree, are certainly tempting enough. They belong to the variety C. Ernest.

Domestic peacocks, now common in almost every country, date from very remote times. To the ancient Greeks the peacock was known as Juno's bird. According to a well-known myth, the strange eye-like markings on its 'tail' were the hundred eyes of Argus, set there by Juno after he was killed at the behest of Zeus while guarding Io.

In days of chivalry a special feast-dish was the roast peacock served up garnished with all its gaudy plumage. Solemn oaths were sometimes taken "on the peacock." Under the Chinese Empire a peacock feather to mandarins for

long been the symbol of splendour and pride. The famous peacock throne of the Mogul emperors at Delhi was of unparalleled magnificence, for it had as its background the figure of a peacock with expanded train wrought all in gold and precious stones and gems.

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Pear. The pear tree, *Pyrus communis*, was probably a native of western Asia, but it is now grown in all temperate climates and is especially popular in Europe, where it is often considered the finest of all dessert fruits.

PEAR

In England the pear is trained to grow on south walls because the climate is too cool for the fruit to ripen otherwise. There are three usual arrangements for the tree fan-wise, from a short stem, as an *espalier*, with long side branches from a vertical stem, or as a *cordon*, a single stem trained at an angle. The last way is favoured for the finest fruit, only a dozen pears or so being allowed to grow on each tree. Pears for perry, a fine drink of the same type as cider, are grown in orchards. The West of England is our chief pear country.

Pears are usually picked while they are still hard and imperfectly coloured, for if they are left on the tree they become tasteless and gritty. After picking they are stored in a cool place to ripen. A pear is at its best for eating when the flesh at the base of the stalk is just beginning to soften. Pears are popular as a dessert fruit and are extensively tanned.

The cultivated pear tree is free from thorns, but on the young wild pear tree the ends of the branches form sharp spines guarding the fruit of the tree. One wild pear, *P. cordata*, is perhaps a native of Britain. Many of the diseases and insect pests which attack the pear are the same as those which attack the apple. Like so many of our orchard fruits, the pear belongs to the rose family.

Pearls. Most shell covered water animals or molluscs line their shells with a secretion which produces a smooth, whitish, shimmering inner surface called *nacre* or mother-of-pearl, much used for buttons, knife and fork handles, inlaid work, etc. This lining is to protect the

delicate bodies of the animals from contact with the otherwise rough covering. Doubtless you have often admired the glossiness of the inside of a shell. The secretion is deposited in a series of milky, satiny, transparent films, which,

hardening, produce a beautiful play of iridescent colours.

A pearl is really a calcareous (limestone) deposit produced by a "sick" oyster or other shellfish. Often a grain of sand, a minute marine creature, or some other foreign body finds its way into the shell and irritates the animal. Then the shellfish, unable to remove it, covers it with successive layers of this membranous substance, and thus pearls are formed. Sometimes the animal is attacked by a parasite boring through the shell from the outside. It repairs the damage by depositing its secretion over the hole in the form of a half sphere, thus forming a blister pearl.

Genuine precious pearls and the most valuable mother-of-pearl are produced by various species of pearl oysters of the genus *Meleagrina*, although inferior pearls are sometimes found in the common edible oyster, and some even in certain species of freshwater "mussel". Since the pearl naturally partakes of the character of the shell, it is useless to look for pearls of value in the dull opaque shell of the ordinary oyster.

Pearl oysters lie on the hard sea bottom at a depth of from 50 to 150 feet. They are collected by divers (*see Diving*). They may be opened on board ship or they may be gathered in boatloads and taken to the beach, where they are spread out to decompose. Afterwards they



OPENING THE SHELLS TO LOOK FOR PEARLS

What a fascinating task this must be! Who knows but the very next shell may contain a pearl worth a fortune? Below is one of the pearl oysters containing a large "stone". Pearls must be handled with care. Hot water destroys their lustre, for this reason pearl rings should always be taken off before washing one's hands. Pearls seem to require the touch of life to keep them brilliant: they have been known to "fall ill" and "die" when not worn for a long time.

DIVING FOR NEPTUNE'S ONLY PRECIOUS GEMS



The pearl is the only precious gem which is obtained from the sea. Unlike mineral gems, such as the diamond, the pearl needs no cutting to improve it. Except for a little polishing it is a finished gem when it is taken from the oyster. The finest pearls come from the Far East, many of them gathered by Japanese or Malaya divers who simply plunge in, holding a heavy stone which helps to pull them to the bottom. Where the pearl gathering industry is better organized, the men are equipped with diving suits as you see here. When one of these divers has been down a long time he has to be pulled up in "stages," waving his arms and legs to quicken his circulation and so get rid of the excess nitrogen he has absorbed while breathing the compressed air. Divers, particularly the naked natives, are occasionally attacked by sharks, or seized by octopuses and held down until they drown.

are washed and the pearls are removed carefully with special pincers or hammers. Seed pearls (the smallest pearls) are found in mussels in the rivers of Scotland, Ireland, Germany, Russia, China, etc.

In the 13th century the Chinese discovered a process for the artificial formation of pearls in river mussels. A minute foreign substance is introduced into the shell of the mussel, creating an irritation and causing the animal to form a pearl. The Japanese are skilful in producing "cultured" pearls, and only an expert can tell the difference between a scientifically "cultured" pearl and one which is natural.

The finest pearls are gathered in the East, the most valuable coming from the oysters of the Persian Gulf. The British Government controls valuable pearl fisheries in the Red Sea, north of Port Sudan. Among other important pearl fisheries are those in the Sulu Archipelago, off the Australian coast, in the Aru Islands, the Pearl Islands, in the Bay of Panama, in the Red Sea, off the Philippines and Burma, and in Ceylon. Black pearls are found chiefly in the Gulf of Mexico and the South Seas.

Peary, ROBERT EDWIN (1856-1920) "Stars and Stripes nailed to the North Pole—PEARY." It was on the afternoon of September 6, 1909, that this dramatic message, flashed by cable and telegraph, thrilled the world.

Peary had actually reached the Pole on April 6, 1909, just five months before his message was received. He was the only white man of his expedition to reach it. With him on the sledging party, in the last dash, were his negro follower, Matthew Henson, and four Eskimos. For fifty-three days they and their dog teams marched across the Polar ice pack, from the last point of land to the Pole, and back—950 miles in all.

It was no accident that the long-coveted prize should have been won by Peary. For 18 years he had hoped and worked, returning time and again to the Polar regions, always learning from his failures, always paving the way for victory. Born in Pennsylvania, U.S.A., and educated at Bowdoin College (in Maine), he had entered

the United States Navy at twenty-five, after a civil engineer's training. In 1887-88 he was chief engineer of the Nicaraguan Canal survey. The year before that, at the age of thirty, he had made his first trip to the Arctic regions, visiting the Greenland ice cap. From that day onward the lure of the North was in his blood, the great white spaces haunted him in dreams, and he could never again live at ease. His wife shared his ambition, and spent several winters with him in the Far North, where their little daughter was born. The child was called the "Snow Baby" by the Eskimos because her skin was so white.

Peat. This is a brown or blackish mass of partly decayed vegetation formed in marshes, swamps, and bogs. All sorts of marsh plants, from mosses to trees, enter into its composition. It is much used for fuel in northern and north-western Europe. Peat is found chiefly in rather high latitudes, mostly in the Northern Hemisphere, merely because most marshes and bogs are found there, and not because, according to a common idea, vegetable matter decays too rapidly to form peat in the lower latitudes.

Most peat hogs are within the area that was once glaciated, because that is where most undrained depressions appropriate for bogs are found. Peat deposits grow in depth from 2 to 4 inches a year.

Peat is formed as follows. The various marsh plants continue to grow above and decay beneath. The decaying matter below is in water, and forms a heavy mass of water soaked tissue, which, as time goes on, becomes thicker and thicker and more deeply buried beneath the new growth. Under increasing weight it is pressed into the rather spongy dark coloured substance known as peat. If the peat is buried deeply beneath sediments, such as mud, it is compressed much more, and at the same time it is cut off from contact with the air. Chemical changes take place in it, and in the course of long ages—millions of years—it is transformed into a form of coal. A large peat bog may hold in an enormous amount of



PEARY'S COMPANIONS AT THE POLE

The historic photograph above was taken on April 7, 1909, by Robert Edwin Peary, the day after he had reached the North Pole, on the site of which he erected a snow cairn surmounted by the Stars and Stripes. The photo shows the five members of his party in the final dash, his negro follower, Henson, in the centre, and four Eskimos.

water, and in Ireland such bogs have been known to burst and carry away houses and trees, flooding and devastating a large area.

Peat bogs tend to preserve vegetable or animal remains which become buried in them. The leaves of plants which compose it are in some cases so well preserved that it is possible for botanists to determine the particular species to which they belonged.

Peat is cut out in blocks by the peasants in Ireland, Scotland, Wales, and other countries and piled in the air and sun to dry. It burns slowly, gives a dense black smoke, and leaves a clean, fine ash. Peat compressed into compact bricks forms a much better fuel than in its natural state, but it has come into general use only where the supply of other fuels is meagre (See illus., p. 1776).

Peeblesshire, SCOTTISH CO. Peeblesshire, an inland county of south-east Scotland, is often known as Tweeddale because the river Tweed rises in the high mountains in the south of the county. Peebles, however, is probably the old name, derived from the "pebylls" or tents in which its ancient inhabitants used to live.

Peebles, on the Eddlestone and Tweed, has a population of 5,900 and is the principal market-town and manufacturing centre of the county. Woollen cloth and tweeds are woven here. West Linton is a holiday resort on Lyne Water, and Innerleithen, six miles from Peebles, has a population of 2,400, and is well-known because of its mineral spring. The North Esk forms the boundary between Midlothian and Peeblesshire for about four miles, and here a number of beautiful landscapes are found, such as Habbie's Howe.

The south-western edge of the Edinburgh coal-field just enters the county, while the highest peak—Broadlaw (2,754 ft.)—is on the border of the county adjoining Selkirk. The streams are well stocked with fish, unpolluted and comparatively unrestricted for fishing, so the

county as a whole is most popular with anglers. As it is essentially a pastoral county, the population is low for the area, the actual figures are 15,100 people in 354 square miles.

Peel, Sir Robert (1788-1850) "Here comes a bobby," shouts the mischievous London street urchin when he sees a policeman approaching, and a lad in Dublin in a similar situation may cry out, "There's a peeler!" Both of these nicknames for the blue-coated officer of the law come from the name of Sir Robert Peel, the British statesman who first organized the London police force (1829) and also the Irish constabulary.

This man, the son of a rich cotton manufacturer, a graduate of Oxford University (1808) with the highest honours attainable, and twice Prime Minister of Great Britain, was the author of many epoch-making measures. He entered Parliament in 1809, at the age of 21, as a Tory who believed in the established order. This was the time when England, in arms against Napoleon, was opposed to all change because of fear of the radicalism of the French Revolution. After the close of the war this feeling wore away, and the march of political progress went on.

When Peel was in the Duke of Wellington's cabinet, in 1829, he proposed and carried through the Catholic Emancipation Bill, giving Catholics the right to become members of Parliament and hold

other offices. This was a complete reversal of the former positions of Peel and Wellington, and it almost split the Tory party, but Peel and Wellington believed that it was the only measure that could preserve peace in Ireland.

While out of office, Peel opposed with all his might the great Parliamentary Reform Bill of 1832. In the years of Whig administration that followed he worked at strengthening the Conservative party, as the Tories were now beginning to be called. As the recognized head of that party, he was Prime Minister in 1834-



SIR ROBERT PEEL

John Linnell painted this portrait of the great English statesman, Sir Robert Peel, who was for many years the leader of the Conservative party in the House of Commons. He is famous as the Premier who abolished the Corn Laws, as the founder of the police force, and for his quarrels with Disraeli.

National Portrait Gallery

1835, but as the Whigs still had a majority in the House of Commons, he soon resigned.

Peel's great opportunity for constructive reform came in his second ministry (1841-46). Tariff duties were lowered, laws limiting the employment of women and children in mills were passed, foreign relations with France and the United States were improved, and a new charter was passed for the Bank of England.

Then came the crowning act of Peel's career, in 1846. Because of a potato famine in 1845 hundreds of thousands in Ireland faced starvation. For a number of years an Anti Corn Law League in England had been agitating to secure the repeal of the import duties on grain, in order to cheapen food, but the Conservative party, largely made up of landlords, had opposed the measure. Although Peel was a "free trader" on all else, on grain he had hitherto followed his party. But now "famine forced his hand," and with the aid of the Whigs he repealed the Corn Laws, as a relief measure for Ireland. Unfortunately for the starving Irish peasantry, Peel's measure of repeal came too late, and thousands of men, women, and children died by the roadside.

Many of Peel's followers deserted him, and he was soon defeated on a Government measure in Parliament and forced to resign as Prime Minister. Though he had "lost a party he had won a nation," and for the remaining four years of his life the liberal measures passed by the Whigs were largely due to his support. When he died, from the effects of a fall from his horse, a few years later, the common people felt that they had lost a friend who had given them "bread unleavened with injustice," and all England recognized the loss of a great statesman. His will directed that he should be buried in Drayton church, in Staffordshire, otherwise he would have rested with the great in Westminster Abbey.

Peerage. The peerage of the United Kingdom includes all those who hold an hereditary title above the rank of baronet. The five orders of the peerage, in order of precedence, are duke, marquess, earl, viscount, and baron. The eldest son of a duke, marquess, or earl is known by his father's second title. Thus, the eldest son of the Duke of Devonshire is the Marquess of Hartington, and the eldest son of the Earl of Derby is Baron Stanley. The younger



'PEELERS' AT THE DERBY

Central Art Library

Sir Robert Peel was for six years Chief Secretary for Ireland, during which period he established a regular police force, the members of which were dubbed 'peelers' a nickname which extended later to the police in England when these were reorganized during his tenure of the Home Office. The term 'bobbies' also refers to Sir Robert Peel. Policemen in those days wore top hats, and our photograph shows 'peelers' on duty at Epsom on Derby Day, 1849.

sons of dukes and marquesses have the courtesy title of Lord before their Christian and surnames, and the daughters of dukes, marquesses, and earls bear the courtesy title of Lady before their Christian and surnames. The younger sons of earls, viscounts, and barons are entitled to the designation the Honourable, as are, too, the daughters of viscounts and barons. A baron is addressed in speaking and writing as Lord.

All peers of the United Kingdom have a seat in the House of Lords but only a certain number of the Scottish and Irish peers are elected by the fellow peers of their countries to represent them. Irish peers, not so elected, are eligible for election to the House of Commons.

As a rule, a peerage only goes in the male line, but in some cases, as in that of the late Earl Roberts, there is a special remainder which allows a daughter to succeed, or, as in the case of Earl Kitchener, a brother.

A few peerages descend in the female line, but when a commoner marries a peeress in her own right, he does not take the title. A lady who marries a peer takes his title and precedence. On her husband's death, if he is succeeded by his son, she retains her title with the word Dowager before it, but if the next heir is not the son, she retains the title with her Christian name before it. In recent years the use of the word dowager has been to a great

extent discontinued, all widows of peers preferring to use their title with the Christian name.

The two archbishops, and the bishops of Durham, London, and Winchester, always have seats in the House of Lords, and 21 other bishops in rotation also take their places as "lords spiritual." Burke and Debrett are famous reference books giving details of the peerage.

Pegasus. When the Gorgon Medusa was slain by Perseus, there sprang from her body, according to the old Greek legend, the



PEGASUS AND HIS MASTER

This medall relief, in the Spada Palace at Rome, shows the Greek legendary hero, Bellerophon, and the winged horse Pegasus, which the goddess Athena helped him to catch and tame. Through his steed's ability to soar into the air, Bellerophon was able to slay the fire-breathing monster, the Chimæra.

Winged horse Pegasus (See Perseus). Bellerophon caught and tamed Pegasus by means of a golden bridle which the goddess Athena (Minerva) presented to him, and, mounted on his back, was able to slay the Chimæra, a fire-breathing monster, part lion, part goat, and part dragon.

Pegasus remained the faithful companion of Bellerophon, carrying him wherever he chose. At last Bellerophon impudently attempted to mount up to heaven, but Zeus (Jupiter) sent a gad-fly which stung Pegasus so that he threw Bellerophon, who fell to the earth, lame and blind. Pegasus was then placed among the stars.

Peking (PEIPING), CHINA. During nine centuries, with occasional interruptions, Peking was the capital of China. But in 1928 the triumphant Nationalist forces captured it, deposed the nominal President of the Chinese Republic, and moved the seat of government to Nanking. To emphasize this break with the past they even changed the name of the city from Peking (which means "Northern Capital") to Peiping ("Northern Peace"). But the rest of the world, feeling (as things have turned out, rightly) that perhaps this decision would not be permanent, continued for the most part to use the ancient name. In August 1937, Japanese troops occupied the city without much opposition, and its name was changed back to Peking.

As you walk down a squalid Peking street groping your way through never-ending streams and eddies of humanity, you may see a caravan of camels lumber by. They have come perhaps across the Gobi Desert, through the Great Wall, bringing rich wares from the north. They force a path through the tangle of horse-drawn carts, man-drawn rickshaws, and some occasional motor vehicles. A lean, bare-legged rickshaw-puller protests, hurling a volley of insults at the camel drivers, while the stately Chinese merchant sitting in the vehicle looks on unmoved, his hands folded in his sleeves.

Walls within Walls

To get a good view of Peking one mounts the famous wall of the Tartar City, as the northern portion of the Chinese capital is called. This wall is 60 feet high and 40 feet broad at the top, with its nine gates surmounted by lofty and imposing watch-towers. It is a relic of the Tartar invasions of the 10th and 12th centuries, and encloses the former Imperial City, which in turn encloses the famous Forbidden City, where the Emperor used to live, and which only a few foreigners had ever penetrated until the Boxer rebellion brought European and American troops to Peking in 1900.

South of the Tartar City is the so-called Chinese City, enclosed by a 30-foot wall, built in 1543. Thus Peking is a double-walled city, with an area of about twenty-five square miles and a circumference of thirty miles.

From the top of the Tartar wall one sees innumerable Buddhist temples and old palaces peeping out from groves of trees, in contrast to the low huddled houses in the more crowded quarters. The red, blue, or yellow tiles of the gracefully curving temple roofs put gorgeous splashes of colour into the scene.

A better view of the Forbidden City can be obtained from Prospect Hill, an artificial mound 150 feet high, topped by five peaks on each of which there stands a temple. Near by are the crumbling palaces and homes which housed the former Emperors and their courts. Gracefully

PEKING

arched bridges of white marble lead over the flower-bordered pools which dot the parks, and everywhere the Oriental love of delicate decorative details is in evidence. One of the old imperial buildings is now a museum of royal treasures—precious stones, porcelain, bronzes, and ancient furniture of unique rarity.

In the Chinese City the most notable building is the Temple of Heaven, with its huge altar, where for five centuries the Emperors prayed to Shang-Ti, the Supreme Being.

But more interesting than ancient palaces or temples is a trip through the crowded bazaars. Furs of tiger, leopard, and wild cat are offered for sale, along with costly embroideries and brocades, jade and porcelain wares, strange sweetmeats and sugared fruits—all mingled in indescribable confusion. Such bazaars are for the Chinese themselves, and Europeans are not wanted there. The foreign residents have their own shops, hotels, and clubs, centring mostly in the Legation Quarter, a self-contained strip of territory that lies against the south wall of the Tartu City.

Peking's environs are also full of interest. Eight miles away is the famous Summer Palace of the former Imperial family. The grounds are a fairyland of artificial mountains, over which wind intricate pathways and miniature streams with waterfalls. A short railway journey will take the traveller to the Nankow Pass in the Great Wall, through which passes most of the trade between Mongolia and China proper.

Where Emperors Lie Buried

In a picturesque, hill-enclosed valley, two hours' journey by donkey from Nankow, are the Ming tombs. An avenue three miles in length, leading to this ancient burial-place of the Emperors of the Ming dynasty, is lined with large images carved from solid blocks of marble, representing lions, elephants, camels, horses, military officials, and sages.

Although Peking is, in peaceful times, the centre of a huge Chinese trade, it is not industrially important, the bulk of the imports being for local consumption. Most of the commerce with the outside world is carried on by railway.



PICTURES OF PEKING

Above is the altar of the Temple of Heaven. Its triple roof, covered with blue tiles, is topped by a copper gilt ball, while the balusters and steps are of white marble. The carved marble boat, top left, is at the Summer Palace, about six miles north-west of Peking. Below is a street in the outer city.

Photos: left top and bottom: Ewing Galloway right: E. N. A.

through the great seaport of Tientan, seventy miles to the south-east, and through Mukden in Manchukuo, 400 miles to the north-east on the Trans-Siberian railway. The trade with southern China passes up and down the famous Grand Canal, which runs 800 miles south from Peking to Hangchow. The population of the city, with suburbs, is estimated at 1,556,000.

Pelican. Mr and Mrs Pelican feed their babies from a cupboard which they carry about with them. This cupboard is a sack of elastic skin grown from the under-side of the beak. It is often 6 inches deep and a foot and a half long, and it will stretch until it is large enough to hold several quarts of fish or other food. Some species of pelicans use this sack-cupboard as a fishing net also, scooping fish into it through their wide-open bills as they swim along on the water.

There are about ten species of these grotesque water birds, found in temperate and tropical regions. The larger varieties are about 5 feet long with wings that sometimes span 10 feet. The neck is strangely bent, and the four toes are connected by a web. The ordinary pelican (*Pelecanus onocrotalus*), which is mainly white with a rosy tinge, occurs in southern Europe and in parts of Asia and Africa. It is found by lakes and rivers, usually in immense flocks. The nest is generally built on the ground, and the eggs, two or three in number, are whitish.

Australia has one species and America has several. One of these American kinds, the American white pelican (*P. tachyrhynchus*) is also an excellent diver. In another American

species the male grows a bony lump on the top of his beak during the mating season. Our native gannet (*g v*) is a not very distant relative.

Pembrokeshire, Welsh Co. This most westerly county of South Wales, 614 square miles in area, is bounded on the east by Cardiganshire and Caermarthenshire and on every other side by the sea. The coast-line is generally wild and rugged, although there are some good bays, chief of which is Milford Haven. The islands include Ramsey, Caldy, Skomer, Grassholm, and Skokholm. The two last named are famous haunts of sea-birds.

The chief physical features are the bold and picturesque coast and the rounded grassy hills which occupy the greater part of the interior, and rise to their highest point in Prescelly Top (1,760 feet). Much land is bare, but the river valleys are well wooded. The chief rivers are the Teifi, Nevern, and Cledau. Cattle, horses, and sheep are raised, and various crops are grown.

During its conquest by the English a colony of Flemings settled in the south and so made "Little England beyond Wales," much less Welsh than the rest of Wales. Haverfordwest (population, 5,000) is the county town. St David's is a cathedral city. Fishguard has important Irish traffic. The total population of the county is 87,000.

Pen. When an ancient Roman wrote a letter he inscribed the words on the wax-smoothed surface of thin boards or tablets with a pointed bone or metal *stylus*. For books and other writings intended to be preserved, the scribe



FUN AMONG THE PELICANS

Pelicans are grotesque birds at any time, but when they begin to perform antics like this (they are trying to pick food up from the ground) they really seem like professional comedians. Yet their strange form has its purpose, and, were it not for the long neck, for example, the bird on the right could not use his beak for his toilet.





WRITING ON PAPYRUS WITH A REED

The ancient Egyptians wrote with a reed called *calamus* which they cut into short lengths and sharpened to a point (see on left). In many parts of the East reed pens are still in use.

wrote on sheets of papyrus or parchment with a split reed pen (*calamus*). The reed pen, which is used to this day in Iran and some other Eastern countries, was the ordinary writing implement in Europe until the introduction of paper made finer pens necessary and quill pens came into use.

The quills were taken from the wing of a large bird, usually a goose or swan. The quill gives us our word "pen" (from the Latin *penna*, "feather"), and the term "pen-knife," which is still used to mean a pocket knife, is a reminder of the days when the pocket-knife was used to sharpen quill pen points.

Experiments were made in the manufacture of steel pens late in the 18th century. A penmaker named Wise produced steel pens in 1803, but they were not satisfactory. Joseph Gillott made a successful steel pen in 1820. John Mitchell used machinery in making pens in 1822. James Peary started making steel pens in 1824, and manufactured the first "slip pens" about 1828. Steel pens are now made in as many as 2,000 distinct styles. The centre of pen nib manufacture is Birmingham.

Pens or nibs are made of the best steel, which is brought to the factory in sheets about $\frac{1}{16}$ of an inch thick—about three times as thick as the finished nib. These sheets are cut into strips just wide enough to allow two nib "blanks" with points interlapping to be cut from them. Then the strips are heated cherry red and slowly cooled to soften the metal. Rollers stretch the strips out until they reach the required thinness and then machines stamp out the blanks at a rate of many thousands an hour. The manufacturer's name is then stamped on, the central hole for holding the ink is punched, and finally the blanks are curved into nib shape.

They now look complete except for the slit down from the ink hole to the point, but the steel is soft and inelastic. So the points have to be hardened by heating and dropping into cool oil, and tempered over a fire.

Gold pen nibs which were first made in England about 1808, have to be tipped with uranium to keep the soft metal from wearing away. They are used chiefly in fountain pens, which have grown steadily in favour since their



ANCIENT MANUSCRIPTS WRITTEN WITH QUILLS

For more than a thousand years, a period when almost all writing was done by monks, the quills of geese or swans were used. In the 18th century quills were improved by hardening usually by dipping in a boiling solution of alum. One of these pens is shown on the left.

HOW THE MODERN STEEL PEN NIB IS MADE



The flat blanks are first stamped out by machine. Machines also cut the little hole which holds the ink, and the two side or shoulder slots which give flexibility. The pen must then be annealed before it is "raised" or rounded between two dies, next the point is ground on emery wheels, and finally, after being tempered, the point is split by a special machine of very delicate construction. A final polish, a little lacquer on the tip to prevent rust, and the pen is ready for market.

first extensive manufacture in England in 1835, but regularity in the flow of ink was first achieved by patents granted to L. E. Waterman in 1884. The modern type of fountain pen has an ink reservoir which keeps the point of the nib always supplied, and which can be filled either with a special filler or automatically by drawing the ink up through the point. The barrel is made of vulcanized rubber or synthetic plastics, and any style of nib can be fitted, according to the demands of the purchaser.

Some fountain pens have a little plunger with which the ink-holder is filled. And in others you turn a little lever to let out the air, put the nib in the ink, and then slowly turn back the lever, when the ink rises into the reservoir.

The stylographic pen is also a reservoir pen, but in place of a gold nib it has a blunt pointed needle or *stylus* in the tip, which also serves as a valve in regulating the flow of ink.

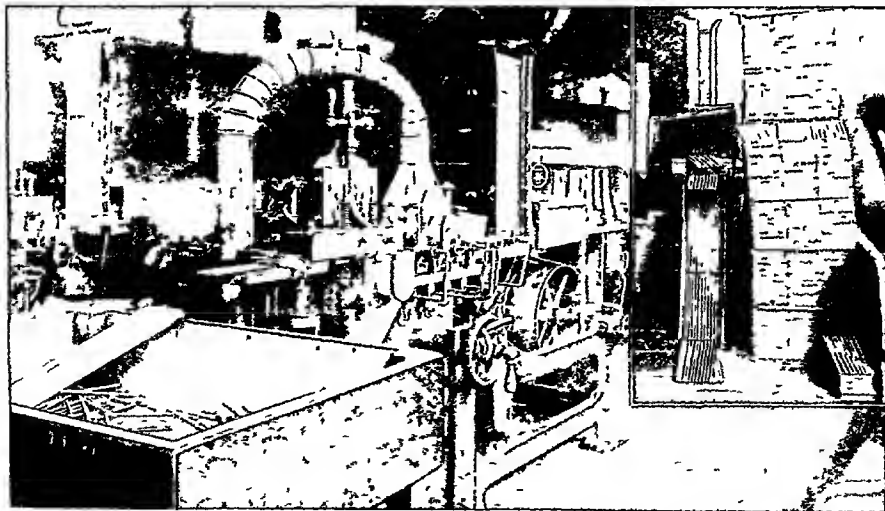
Pencil. Think of the forests of timber that are cut down to supply the wood for making pencils! The only really satisfactory wood for the purpose is the soft, rather "cheesy" red cedar. This type of cedar wood comes mostly from Virginia in the U.S.A. A similar wood, a little harder and heavier, is grown in

large quantities in Kenya, East Africa. These woods are now becoming scarce, and the Californian incense cedar is now largely used.

"Lead" pencils we call them, but the pencils of today do not contain lead, but graphite (*graphite*). Lead was formerly used for this purpose, and the name has stuck. Chalks, coloured earths, and lead have been used for marking and drawing ever since the days of the Romans. The introduction of graphite for this purpose began in England in the last half of the 16th century, supplies being obtained from the famous Borrowdale mine in Cumberland. The black mark of the graphite gave it its name of "black lead."

At first pencils were made by pulverizing the graphite, compressing it into solid blocks, and cutting tiny bars from these blocks and enclosing them in cases. But since 1795 clay has been mixed with the graphite to produce "leads" of various grades of hardness, the more clay, the harder the pencil. The grade of a pencil is marked on it. For instance, HB (a very widely-used grade) is a "hard black" pencil, B is soft, and BB very soft.

Sometimes a little lamp black is added to increase the blackness. The thick, doughy



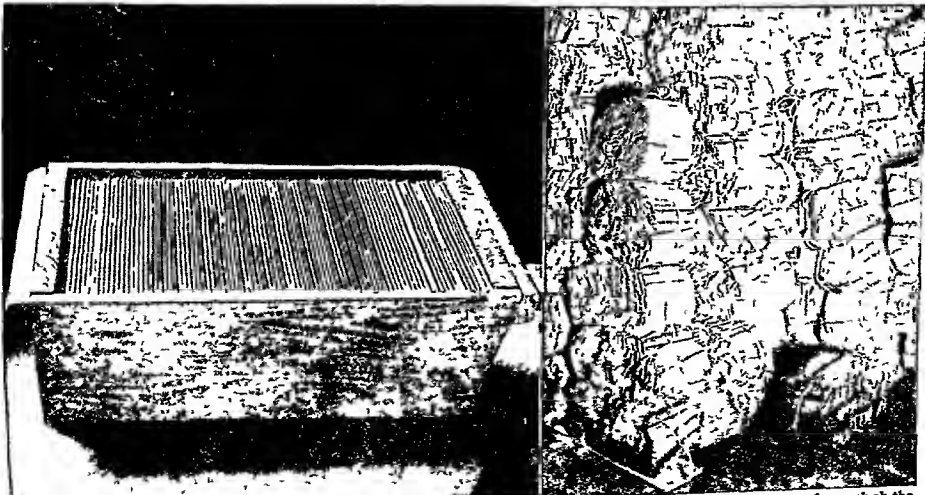
HOW THE LEAD GETS INTO THE PENCIL

These two pictures show how the leads and the wood are put together into pencils. In the smaller picture in the upper right-hand corner, the wooden slats are passing through a "grooving machine," which cuts channels just large enough to receive the leads. The grooved slats and leads are then fed into the machine shown in the larger picture. There the grooved side of two slats are glued together, with leads enclosed, and then the slats are split into separate pencils. These are trimmed down, either round or hexagonal, as desired, and the pencils are delivered to the large box at the extreme left. You can see the pencils made from one set of slats emerging from the left end of the machine.

PREPARING THE LEAD TO GO INTO THE PENCILS



These two pictures show the processes which make the "lead." Purified graphite, clay, and lamp black are mixed into a dough, and the dough is fed into the machine at the left. This machine forces the dough through holes in one plate after another, each hole being smaller than the one preceding. The "dough" emerges from the last hole as a string of the desired thickness. The string is cut into proper lengths. Then the pieces are straightened and baked for several hours in theovens shown in the right-hand picture.



At the left is a box of baked leads, ready to be made into pencils, and at the right are the bundles of wooden slats from which the covering for the leads will be cut. Each slat has been carefully sawed out to a size which will yield exactly the desired number of "casings," so that there is very little waste in trimming.

mixture is then squeezed by hydraulic pressure through perforations in a plate until it is smooth enough, and finally through a perforation the size of the finished lead. As the long black strings cool up like a wire on the board below, they are nipped off into pieces of the right length, straightened out, and allowed to dry. After drying, the pieces are packed into trays, sprinkled with carbon dust, and baked until all the moisture has been extracted.

The leads are now ready for the cases, which are made by milling the wood into little "slats" 7 inches long, 2 inches wide, and $\frac{1}{4}$ -inch thick, and cutting six little grooves in them just big enough to hold the leads. The leads are slipped into place, and a cover slat is glued on and clamped. When these "blocks" have dried sufficiently a shaping machine mills each of them into six perfectly formed pencils, which are stained, varnished, labelled, supplied with tips and rubbers, and boxed, all by machinery.

Coloured and 'Screw' Pencils

Coloured pencils are made by mixing chalk, clay, or wax with colouring matter. Carpenters' and markers' pencils, which are very soft, have a little wax and tallow added to the graphite. A popular form of propelling pencil has a casing of metal and a lead that is allowed to slip forward at the point as needed.

When a new lead is inserted in the point, its tip is caught in a clutch on the end of a rod bearing a driving stud on one side. This stud is seated in a spiral groove cut along the length of a cylinder inside the barrel and connected to the cap. Turning the cap turns the cylinder, and the stud of the clutch moves down or up in the spiral, causing the lead to protrude for writing or withdraw into the barrel. Extra leads are carried in a magazine, usually with an eraser at one end, all under the removable cap.

Pendulum. One day in 1583 a youth of 19 made a great discovery. The scene was the cathedral of Pisa, in which a great lamp swung to and fro on a long chain. The youth timed the vibrations of the lamp by his pulse, and found that no matter how the length of the swings varied, they were always finished in the same time. From this discovery of Galileo's grew the pendulum—still used in many clocks of our day. (See Clocks and Watches.)

If we pull a pendulum slightly to one side of its position of rest and then release it, it swings downward under the pull of gravity until it reaches the centre. Then its momentum carries it beyond this point. Soon gravity overcomes momentum, and the pendulum starts back. It swings to and fro until it stops, but the time of each beat or "oscillation" is always the same. The force of gravity is the same on each side of the centre, so that the swings take place in equal times, regardless of the weight or

material of the pendulum. The only factors affecting the period of the pendulum are the force of gravity and the length of the rod. This swinging of equal arcs in equal times is called "isochronism."

We can control the period of a pendulum, therefore, by adjusting its length. Every pendulum now has a screw below the weight, or "bob," by which it can be raised or lowered on the rod, to regulate the time of beating. Perhaps you have seen an old-fashioned clock regulated by raising the pendulum bob to make it go faster or lowering it to make it go slower. The length of a seconds pendulum (one which ticks once a second) is about 39 inches.

How Does Weather Make Clocks Fast?

Since most substances expand with heat and contract with cold, a clock with an ordinary pendulum goes faster in cold weather (when it is shorter) than in warm weather (when it is longer). Different substances, however, expand at different rates, and thus it is possible to make a "compensating pendulum" in which the bob is raised by the expansion of one metal and lowered just as much by the expansion of another. In the mercury compensating pendulum, the weight is a jar of mercury so adjusted that the rise of the mercury in the jar exactly makes up for the lengthening of the steel rod.

Within recent years an alloy of steel and nickel, called "invar," has been discovered which does not appreciably change length with temperature change. Many fine astronomical clocks have invar pendulum rods.

Since the force of gravity varies at different points on the earth's surface (see Gravitation), the time of oscillation of a given pendulum will likewise vary according to latitude and height above sea-level. The pendulum is therefore one of the best possible measures of gravity that we possess.

Penguin. Seen from a distance, a colony of these strange sea birds of the Southern Hemisphere might easily be taken for an assemblage of little men in evening dress. They stand erect and flat-footed, often drawn up in long regular files, like soldiers, and they walk with a tread so stately and dignified that the sight is irresistibly comical.

The largest species, the emperor penguin, stands about 3 $\frac{1}{2}$ feet high, and weighs 80 lb.

Agos ago the ancestors of the penguin could fly as well as any other sea bird, but today its wings are short paddle-like flappers, entirely useless for flight. Since the bird inhabits only remote lands, where it has few human or animal enemies, and feeds entirely on fish, it has come to spend all its time on land or in the water. In the course of long evolution its wings have become very small and stiff and lost their long feathers until now they cannot be moved at

the middle joint like the wings of flying birds, but are covered with tiny, scale-like feathers which are as waterproof as the scales of a fish.

But the penguins are wonderful divers and swimmers, using their wings one after the other as a man paddles a canoe with a double paddle, and steering with their feet. They have also developed a very thick coat of fat to protect them from the intense cold of the Antarctic regions.

The haunts of these birds are the islands of the Pacific and Antarctic oceans, and the rocky coasts of New Zealand, Australia, parts of South America, and certain islands off the Cape of Good Hope. There they nest in great colonies, and from their nesting-places is collected some of the fertilizer called guano. Sometimes these "rookeries," as they are called, are some distance from the sea, to and from which the penguins pass in continuous procession. In spite of their cold homes, they live well in captivity in Britain, even the sub-polar king penguin breeding in our zoos. Next to the emperor this is the largest species.

The eggs of the penguin are of a chalky white or greenish colour. The baby birds are hatched

blind and require care for an unusually long period before they take to the water. For this reason the emperor penguin breeds in the midst of the Antarctic winter, holding its egg in a pouch between its legs. If it did not breed then, the young would not be sufficiently fledged to endure the next winter in the open. The grown birds bite savagely when molested, but they show little fear of Man, since for untold generations they have lived in regions where human beings are rarely seen.

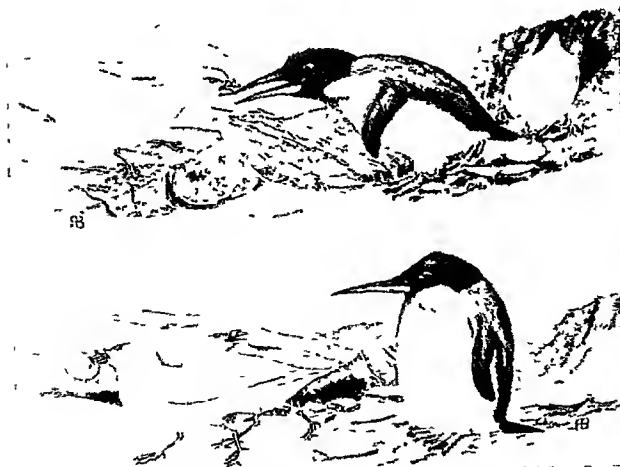
Penn, WILLIAM (1644-1718) The despised and persecuted sect of Quakers were greatly elated when William Penn, the talented young son of Admiral Penn, became an open convert to their religious views, taking so prominent a part in their demonstrations that he was expelled from Oxford.

At first the admiral stormed at his son, for Charles II had intended raising the elder Penn to the peerage, but withheld the honour when he heard that the son had become a Quaker. The father's anger, however, was short-lived, he soon forgave his son, and the rich and highly-placed William Penn became the most prominent Quaker in England.

Penn became, too, the most famous of all the colony builders of America. His province of Pennsylvania ("Penn's Forestland") was a princely domain of 40,000 square miles, which the king granted to him in 1681 in payment of a debt owed by the Crown to Admiral Penn.

William Penn had frequently suffered persecution for his religion. Neither he nor his fellow-sufferers could find a place of refuge in any of the established colonies of America, for the Quakers were regarded as undesirable citizens. It was, therefore, to found a haven for people of all creeds or of no creed that Penn in 1681 sent out the first settlers to his colony.

Although the power to make laws, establish courts, and otherwise regulate the affairs of the colony was conferred upon Penn by the king, he established a popular government, giving to the people the right to elect an assembly to make their own laws. Penn's most conspicuous success was in his dealings with the Indians. He bought from



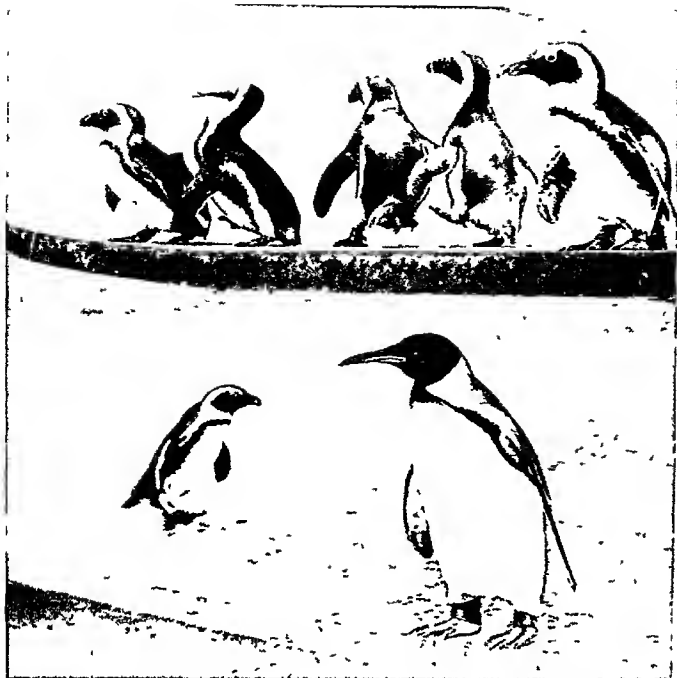
A TRAGICOMEDY IN THE ANTARCTIC

Of all egg-stealers, undoubtedly the worst robber is the sheath-bill, an Antarctic bird which haunts the rookeries of penguins and shags. Here you see two sheath-bills getting a meal at the expense of a poor helpless penguin. One of the sheath-bills annoys the penguin, who reaches forward to attack, thus leaving her nest unprotected. The second makes a thrust at the egg with its sharp beak, and the two thieves triumphantly march away with their booty, the penguin apparently still unconscious of her loss.

PENGUIN PROMENADE IN A FROZEN WORLD



The king penguin is one of the most remarkable of all birds for it lives, and succeeds in rearing its young, in a world of perpetual cold within a short distance of the South Pole. We think of penguins as black and white creatures, but this one as you see is a brilliantly handsome bird—black, blue, yellow, and white, with scarlet on its bill. The adult's feathers are modified almost into scales but the young bird has a warm coat of down that is more like fur than feathers.



PENGUINS IN THE ZOO

HERE are some penguin pictures from the London Zoo, for, though these creatures come chiefly from the coldest regions of the Far South, they not only live but thrive and breed in our own comparatively temperate climate. Above, a party of them are hurrying along the curved "staircase" that leads out of their pool, so as to be in time for a meal brought by their keeper. A king penguin stands below with the first member of the party. In the photograph to the right, another king penguin is standing proudly above a youngster, only three days old and as yet too weak to stand upright. The baby is perhaps feeling rather "out of it" amongst his grown up companions.

Photos Sport & General



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WILLIAM PENN MAKES A TREATY WITH THE DELAWARE INDIANS

The painting, now in Independence Hall, Philadelphia, of which this is an engraving, commemorates the interview between William Penn and the Delaware Indians in 1683, by which was concluded the treaty of amity described by Voltaire as the only pact of the kind which was neither sworn to nor broken. This ensured the freedom of Pennsylvania, the state which was named after Penn against Indian invasions. The picture was painted by Benjamin West (1738-1820).

them the land included within his grant, and they agreed to "live in love with William Penn and his children as long as the sun and moon give light."

Penn had established a home in Philadelphia, the capital of his colony, and there he would gladly have spent the remainder of his life. But after two years in the colony he was called back to England by business and was detained there for 15 years.

After the Revolution of 1688, which brought William and Mary to the throne, Penn was suspected of giving aid and comfort to the deposed James II, and was once arrested for treason. In 1692 he was deprived of his colony, but two years later he regained it.

In 1699 he revisited Pennsylvania. Vast changes had taken place during his absence. Twenty thousand people now inhabited the province. They demanded an even more democratic government than Penn had given them before. He granted their request, and the charter which he conferred upon them in 1700 remained in force for 75 years—until the War of Independence.

In 1701 Penn made a final farewell to Pennsylvania, and sailed again for his native land. On reaching England he found that he had been robbed of the remainder of his fortune by a dishonest steward, and to avoid further extortions he allowed himself to be thrown into prison for debt. He was finally released by his friends, but not until his health had been permanently affected.

Pennsylvania, U.S.A. The "Quaker State" is one of the thirteen original states of the American Union. Its eastern boundary is the Delaware river. The greatest extent from north to south is 174 miles and from east to west 306 miles, and it covers over 45,000 square miles. Harrisburg (population, 80,000) is the capital, and other important cities are Philadelphia (q.v.), Pittsburgh (q.v.), Scranton, and Erie.

It is for the most part high country, the mountain ranges including the Blue and the Allegheny Mountains. The chief rivers are the Delaware and the Susquehanna.

The State is enormously rich in minerals, including coal, anthracite, iron, and petroleum. Half of the coal mined in the U.S.A. comes from

Pennsylvania. There are quarries and cement works. Fine wheat, maize, and hay are grown, and market-gardening, fruit-growing, and forestry are actively engaged in.

The State was founded by William Penn (qv) as a colony for the persecuted sect of Quakers, under a charter granted to him by King Charles II in 1681. It is the second largest State in the U.S.A., with a population of about 9,631,350 persons.

Pension. When a man or woman comes to the end of his or her life's work in the Civil Service, the Services (Army, Navy, Air Force, etc.), or a number of other employments, public or private, a money allowance, known as a pension, is made. In most cases a deduction of five per cent or so has been made from salary to pay for this pension.

The World War of 1914-18 saw an enormous addition to the pensions granted by the State, with special War Pensions for disabled ex-Service men, soldiers' widows and orphans, and the like. A separate Government Department, the Ministry of Pensions, was created in 1916 to deal with such pensions.

Old Age Pensions of ten shillings a week are paid to all persons who have reached the age of 70 when the combined yearly income of husband and wife does not exceed £99 15s. Moreover, those insured under the National Health Insurance Act have been able, since 1925, to contribute an extra amount for Pensions insurance, and thus qualify for Contributory Pensions at the age of 65. In this case after 70 years of age the pension is continued as an old age pension irrespective of means.

Blind persons are entitled to a pension at 50 (to be lowered to 40). Another class of pensions is the Civil List Pensions, granted to persons who "by their useful discoveries in science, and attainments in literature and the arts, have merited the gracious consideration of their Sovereign and the gratitude of their country." The sum of £2,500 per annum is set aside for such monetary assistance to highly-deserving persons of small means.

Peony. More than a thousand beautiful varieties of the peony exist. Nearly all of these are derived from the old-fashioned garden peony (*Paeonia officinalis*), which produces large solitary blossoms, usually red or crimson, but varying to white, early in the summer, or from the white peony (*P. albiflora*), a native of Siberia, which bears beautiful white and pink fragrant flowers. The flowers are usually double, but some varieties are single, in size they are often as big as a baby's head. The flowers of the Chinese peonies, a large group of hardy hybrids, are fragrant and double, and vary from pure white to crimson and mahogany.

All these peonies are herbaceous, with tuberous roots.

Less common are the shrubby tree peonies, although they are so beautiful that they deserve to be better known. One species, native to Japan, grows to 5 or 6 feet high and bears large single or double slightly fragrant flowers, often 8 to 10 inches across. Another tree peony, introduced from China, where there are hundreds of varieties, has striking yellow flowers and blooms in the late spring. The peony grows wild on the little island of Steep Holm in the Bristol Channel, but nowhere else in Britain.

Pepper. Taxes and tributes were often paid with pepper in former days, for it was considered a rare luxury.

Its great cost in the Middle Ages was one of the reasons which induced the Portuguese to seek a sea route to India, and after the discovery of the passage round the Cape of Good Hope the price fell considerably.

The fruit of the pepper plant (*Piper nigrum*), plucked before it is fully ripe and dried, yields common black pepper. White pepper is produced from either the ripe fruit or from the coatings of the dried black pepper berry.

A native of India, pepper is now grown in many tropical countries, including Sumatra, Borneo and French Indo China. Singapore is the chief shipping port.

Other kinds of pepper are obtained from various plants of entirely different families.



A FINE GARDEN PEONY

Although deep red is the most usual colour for this favourite summer flower, modern varieties range from scarlet and all shades of pink to pure white. Here you see a glorious pink type with a double bloom.

Courtesy of Amateur Gardening.



PEPPER IN THE STRAITS SETTLEMENTS

Peppercorns are the fruit of a shrub cultivated in the East Indies. The little rounded fruits are red at first, but later turn black, and when ground they form black pepper. White pepper is produced from the ripe fruit or from the outer coating which has been removed before ripening.

The most important are the red peppers or "chillies" of the tropical and temperate zones, which belong to the genus *Capsicum*. The fruit is either green or red, and used ripe, and in tropical America is considered a necessity of existence. There are many kinds, varying in size and form of fruit, and these are often seen as scarlet objects in mixed pickles, etc. Some of the small varieties are as hot as fire, such as the cayenne peppers (named after the city of Cayenne, French Guiana), which are the ground red peppers of the dinner-table. The so-called Jamaica pepper is not a true pepper, but belongs to the myrtle family, and is better known as allspice or pimento.

Pepsin. One of the most important agents in the digestion of food in the stomach is pepsin. This is a ferment or enzyme, believed to be secreted by glands in the mucous lining of the stomach. It is found in the stomach secretions of nearly all vertebrates.

Pepsin has the power of digesting proteins (tissue-building foods like lean meat, peas, and the white of egg), changing them into peptones, which are soluble and thus capable of absorption in the alimentary canal. But it is useless

in the digestion of fats or carbohydrates. Its action is greatly stimulated by the presence of the hydrochloric acid which is also secreted by the stomach. (See Digestion)

When the human digestive organs become disordered and the proper amount of pepsin is no longer secreted, pepsin is given as a medicine. Commercial pepsin is produced by drying the mucous membrane of the stomachs of pigs, calves, and sheep.

Pepsin is one of the ingredients of most of the medicines that are prescribed for indigestion. If a healthy stomach is dosed with such digestive preparations, it soon ceases to secrete its own pepsin—in accordance with the law of Nature that an unused organ tends to disappear. Pepsin has never been prepared in a pure state, and its chemical composition is unknown.

Pepys, SAMUEL (From pēps or pep'-is) (1633-1703). To write an account, day by day, of what you have been doing, seeing, hearing, feeling, and thinking, for nine years, keeping back nothing, is something of an achievement. This is what this prominent Admiralty official in the time of Charles II did, from the year 1660 to 1669. The diary was written in a kind of shorthand and left, with his library, to Magdalene College, Cambridge. About 1820 the Rev. John Smith deciphered it, and it was published in 1825. Two other diaries, of a more official character, emerged when a mass of



SAMUEL PEPYS, THE DIARIST

This portrait of the immortal English diarist, by John Hayls is in the National Portrait Gallery, London. But an even more vivid portrait of the man can be found in the pages of his delightful diary. His fame as a writer has rather obscured the work of lasting value he performed at the Navy Office.

Pepysian documents was being examined in Magdalene College in 1935. They were dictated to clerks, and written in the ordinary way.

Pepys was the son of a tailor, and was born in London. He was educated at St Paul's School, London, and at Cambridge, and in 1630 was made Clerk of the Acts in the Navy Office, rising in course of time to a high position. He became a Member of Parliament, was Master of Trinity House for nine years, and was elected President of the Royal Society in 1684. He was very fond of music and the theatre.

The World's Most Famous Diary

Although he was an able, patriotic, hard-working official, it is by his diary that Pepys' name will live. Other people have written diaries and confessions, but with an eye to publication Pepys apparently had no intention of having his diary published, and never has such an intimate revelation of a man's life—his work, his leisure, everything—been given to the world. Moreover, famous historical events like the Great Plague and the Great Fire of London are vividly described in its pages.

Percentage AND INTEREST In making business and other calculations it is very usual to reckon by percentages, that is, by hundreds, the words "per cent" meaning "per hundred" or "for each hundred." To find 3% of a number, the number is multiplied by $\frac{3}{100}$.

Thus 3% of 600 = $\frac{3}{100} \times 600 = 18$.

Notice in the problems below how very easy it is to find the percentages by decimals, by first marking off mentally two decimal places to get 1% of each number, and then finding the whole number required. In finding 3% of 200, think of 1% as 2.00 (that is, as 2), and 3 per cent as three times that amount, or 6. Find

2% of 400, of 700, of 900, of 1,100, of 2,200.

Certain percentages are computed more easily when the fractional equivalent is used in place of the decimal. To find 25% of a number it is easier to use the fraction $\frac{1}{4}$ than the decimal .25. To find 33 $\frac{1}{3}$ % of a number it is easier to use the fraction $\frac{1}{3}$ than the decimal .333. Thus, 25% of 1,200 = $\frac{1}{4}$ of 1,200, or 300. The most important of these equivalents are

20% = $\frac{1}{5}$	50% = $\frac{1}{2}$	12 $\frac{1}{2}$ % = $\frac{1}{8}$
40% = $\frac{2}{5}$	75% = $\frac{3}{4}$	37 $\frac{1}{2}$ % = $\frac{3}{8}$
60% = $\frac{3}{5}$	33 $\frac{1}{3}$ % = $\frac{1}{3}$	62 $\frac{1}{2}$ % = $\frac{5}{8}$
80% = $\frac{4}{5}$	66 $\frac{2}{3}$ % = $\frac{2}{3}$	87 $\frac{1}{2}$ % = $\frac{7}{8}$
25% = $\frac{1}{4}$	16 $\frac{2}{3}$ % = $\frac{1}{6}$	14 $\frac{2}{3}$ % = $\frac{2}{9}$

By using fractional equivalents find

- 25% of 48, of 800, of 1,000, of 20,000
- 33 $\frac{1}{3}$ % of 80, of 900, of 1,500, of 33,000
- 87 $\frac{1}{2}$ % of 40, of 800, of 1,600, of 32,000

It seems more difficult, perhaps, to find what per cent one number is of another. But it is really a very simple case of division and finding the right place to put our helpful decimal point. (See Decimals) "What per cent is 60 of 80?"

really means dividing 60 by 80, or reducing 60/80 to a decimal, thus

$$\begin{array}{r} 80 \overline{) 60.00} \\ \underline{50 } \\ 10 \\ \underline{80 } \\ 20 \\ \underline{20 } \\ 0 \end{array}$$

In other words, 60 is 75% of, or 75% of 80. See if you can solve the following problem.

If your football team plays 24 games and wins 18 of them, what is the percentage of victories? Should it rank higher or lower than a team that plays 33 games and wins 21 of them?

The only difficulty is that people get confused as to "which number is to be divided into which." Just watch for the little word of. What per cent is 17 of 34? What per cent of 72 is 24? The of is always in front of the number you are going to use as a divisor.

A common use for percentages is in computing interest on money borrowed from a bank, or on that invested in some form. A manufacturer borrows from a bank, say, £500. The bank charges him at the rate of £25 a year for the use of the money. This charge of £25, or 5% of £500, is called "interest."

The money upon which interest is paid is called the "principal", the percentage charged is called the "rate" of interest, the time for which interest is paid is called the "term", the principal together with the interest is called the "amount". In the illustration above, £500 is the principal and 5% the rate. If the manufacturer repays the money in three months' time, three months would be called the term.

To find the interest on a given principal for a given term, the principal is multiplied by the rate, and this product by the time expressed in years or a fraction of a year. We may express it thus

$$\text{Principal} \times \text{Rate} \times \text{Term} = \text{Interest}$$

To find the interest on £1,200 at 6% for six months, the following form, since it admits of cancellation, is a convenient one

$$\begin{array}{l} \text{£1,200} \times \frac{6}{100} \times \frac{1}{2} = \text{£36} \end{array}$$

Interest is either simple or compound. The former is payable on the principal alone, and the latter on the amount of the principal plus the interest as and when it falls due.

The compound interest on £100 at 8% per annum is £3 for the first year. For the second year, however, the principal is £103, so the interest for the second year is £3.1s 9d. This is added to the £103 in order to obtain the principal for the third year, and so on.

A formula may be used, in order to simplify the calculations involved. This is

$$(P + R)^T = I$$

where P is the principal and R the rate, T the term, and I the interest. This means that the sum of the principal and rate must be multiplied by itself once for each year that interest is due.

Perch. This fish (*Perca fluviatilis*) is one of the commonest of our freshwater fishes. It is also one of the easiest to catch, for it is so greedy that it will usually rush at anything in the way of food, and is especially fond of worms and similar objects. In colour the perch is a handsome fish, bronze brown with dark stripes, and the large back fin, with sharply pointed rays, is typical of the whole perch family. Its stripes, which are clearly visible in the photograph on the right, are a form of camouflage or "dazzle painting," and they serve to disguise the fish from its enemies and victims, since they resemble the narrow stems and leaves of water weeds and rushes.



STRIPED PERCH IN THE AQUARIUM

This fish is a common perch, one of the most frequent species in streams, canals and lakes all over England. It is a handsome fellow, with its striped sides and big, spiny fins and is popular with anglers, since even small ones give good sport on rod and line.

If you catch a perch, be careful how you handle it, for the fins may cut your hands very badly.

Large perch are cannibals and are very fond of small fishes of all sorts, so that they are often caught by "live baiting" in the same way as pike (*See Pike*). In some countries where sea fish are not available perch form an important article of diet. But in England perch are considered too bony to be worth eating.

Perfumes. Every corner of the globe is unsatiated to supply the rare and delicate odours used for milady's toilet.

The sweet scents that perfume our soaps and sweets, or that we put on our handkerchiefs, come from far away Zanzibar, Uganda, Java, Cyprus, China, Tibet, Burma, Peru, San Salvador, and a hundred other distant and romantic places. Millions of pounds of lovely roses, orange blossoms, violets, and other flowers are gathered and taken to great perfume factories to yield up their fragrance. Odorous woods, seeds, roots, resins, and spices are collected in the forests of remote lands. Animals that secrete substances of pleasing aroma are ruthlessly slain for their scent glands.

The world contains few more interesting sights than the perfume-making district of southern France, around Grasse, Cannes, and Nice. Beautiful fields of flowers stretch away on every side, filling the air for miles with their delicate scents. In the fields you see men, women, and children gathering the precious blossoms and heaping them up in great baskets, and along the roads pass streams of wagons, each filled to the top with loads of flowers for

the factories. There each little blossom gives up its tiny drops of fragrant oil to be bottled, and sent perhaps to some far distant corner of the world.

There are two principal classes of perfumes, the animal and the vegetable. Of the animal perfumes, musk is the most important. Obtained from the musk deer (*q v*), it is a powerful and enduring perfume and gives odour to everything in contact with it or near it. Musk is used in minute quantities to give permanence to other odours that by themselves soon disappear. Its price is now very high, because of the growing scarcity of the animal that produces it.

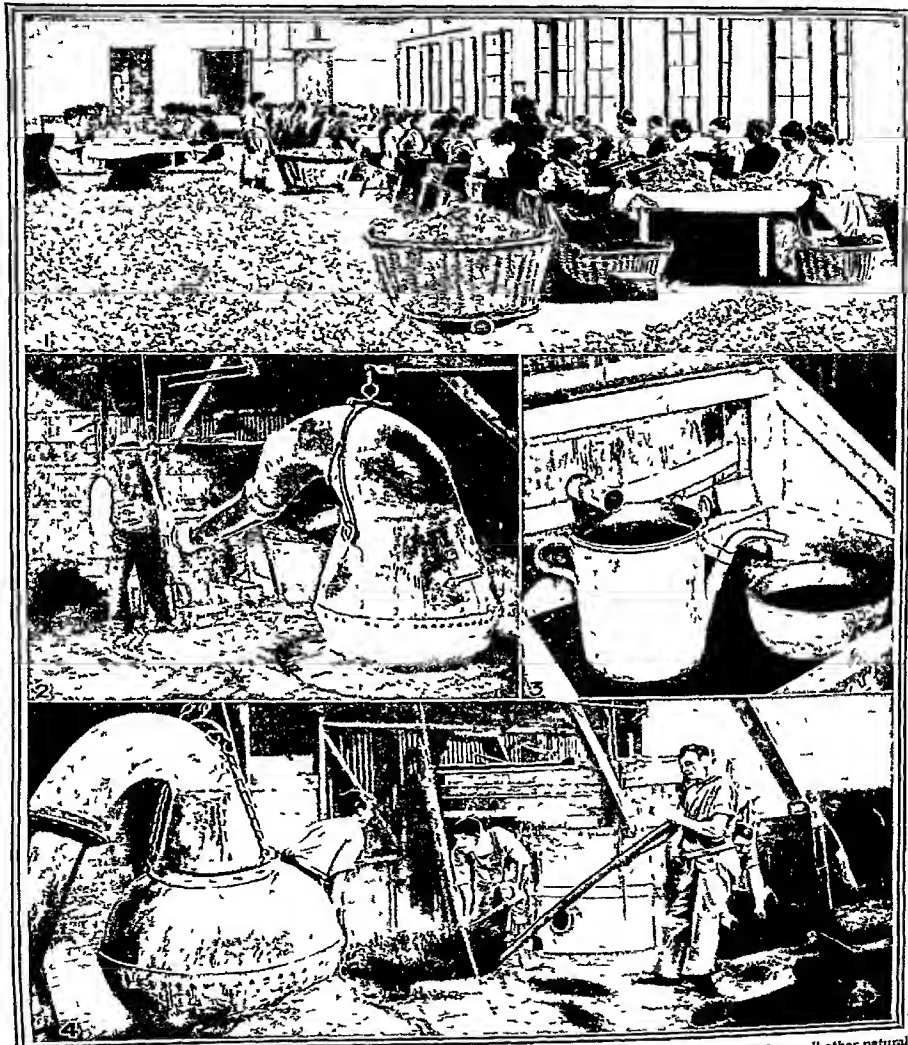
Ambergris is a secretion of the intestines of the sperm whale. It is a waxy substance of different colours—white, black, yellow, ash grey, or variegated—and it is frequently found floating in large masses (as heavy as 200 lb) in the Indian Ocean and other tropical seas. Such a large piece is a tremendous haul for its discoverer, being worth several thousand pounds. Civet comes from glands of the civet cat, a native of Asia and northern Africa. It has, when pure, a most powerful odour, which is almost unbearable. It is useful in diluted form in soaps and sachets. Castor, from glands of the beaver, has a strong, lasting, penetrating odour which is very pleasant, especially when the perfume is old.

Fragrant Gums for Incense

Of the vegetable or plant perfumes, the simplest are those exhaled by dried flowers, such as lavender, these are often combined with spices, odorous woods, and herbs. The most important of the fragrant gum-resins are benzoin, myrrh, and the balsams. Great quantities of these sweet smelling gums and balsams are employed in the manufacture of incense for church use.

Most of our perfumes, however, are obtained by removing the fragrant oils from plants by various processes. Those obtained by distilling flowers, bark, seeds, or other odour-bearing substances are called "essential oils," or "otols" or "attars," from the Persian word *ater*. The active principle of odour-bearing plants is contained in the sacs or glands, its purpose being in many cases to attract insects. These may be in the rind, as in a lemon or orange, in

CATCHING THE SWEET SPIRIT OF THE FLOWER



These photographs were taken during the preparation of oil of lavender, but the process is the same for making all other natural vegetable perfumes. The finest lavender is prepared from the flowers alone, but frequently the stems are also put through the process. 1. Women sorting petals and removing any foreign matter which may have been gathered with the flowers. 2. The petals are boiled in a great retort, from which the vapour is drawn off and condensed in the tank at the left. 3. The distilled liquid emerges from the still. 4. Removing lavender stems from the still after distillation. This is done with long rakes.

leaves, as in sage and thyme, in bark, as in cinnamon, in seeds, as in caraway and nutmeg, in the petals, as in the rose and lavender, in the wood of the stem or roots, as in sandalwood and rosewood

The problem of the perfumer is to get the essential oil as pure as possible without losing any of its properties, and extraordinary delicacy and care are required in the operations entailed. Sometimes the flower is crushed and soaked in alcohol, as in the case of the iris. Or the oil may be squeezed out by hand, as from citron, orange, and bergamot. Others are distilled, as roses, lavender, rosemary, and sandalwood

Attar from Rose Petals

The most important of these oils is the famous attar of roses, which is chiefly obtained by steam distillation of rose petals in France. Smaller quantities come from Iran, India, Syria, and Turkey. An acre of roses yields about a ton of rose petals under favourable conditions, and a ton of the petals makes from 10 ounces to a pound of the oil of roses, so it is easy to see why the price is high. The odour is so powerful that one drop is enough to give fragrance to a gallon of eau de Cologne. Attar of roses is chiefly used as an ingredient in perfumes and toilet waters, but may also be obtained in tiny bottles containing only a few drops.

For very delicate flowers more subtle means are necessary to capture their fragrance. These

processes depend on the power of fats to absorb odours, and are known as the cold process, or *enfleurage*, and the hot process, or *maceration*. In the cold process, lard, beef-suet, or some other grease is spread out thinly on glass plates and air is passed over the flowers and to the lard. The flowers are renewed until the fat contains all the perfume it can take up. In the hot process, flowers in linen bags are hung in jars of warm lard or vaseline till the perfume is taken up. The perfume is then dissolved out of the fat with various solvents.

Making Perfumes in the Laboratory

Besides these animal and vegetable perfumes various artificial or synthetic perfumes are made, sometimes by combining chemicals, but generally by the chemical manipulation of plant oils. Some of these synthetic perfumes have a remarkable similarity to natural perfumes. But no chemist has yet succeeded in producing perfumes so delicate as Nature's.

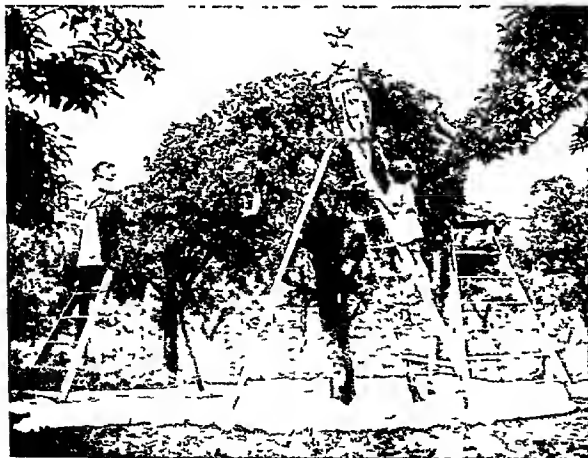
This is partly because the theoretically simple process of blending the various aromatic compounds is actually very difficult, and partly because the slightest impurity—one which it may be difficult to detect chemically—may spoil the perfume, as a false note spoils the rendering of a musical composition. Therefore, though a synthetic musk, an artificial vanilla, and many other substances used by perfumers are compounded

in the chemical laboratory, they are used chiefly in the cheaper grades of perfumes, and have not as yet diminished the demand for the natural perfume bases, for this reason the price of fine perfume is as high as ever.

From the earliest times men have prized perfumes and known the art of making them. Perfume bottles are frequently discovered in excavating sites of the ancient East, and early literature is full of references to precious sweet-scented oils. In the Middle Ages the Arabs were skilled makers of perfumes.

France and Italy also learned early the art of making perfumes, and France is still the greatest centre. England is unsurpassed for its lavender and peppermint

Pericles. (Pron per'-i klēz) (About 490-429 B.C.) When we think of Athens, the greatest city of Greece, at the height of its glory, we think of Pericles, the statesman who



ORANGE BLOSSOM FOR THE PERFUME FACTORY

During the month of May there is great activity in the flower fields of the French Riviera, for then the fragrant blooms are gathered to be sent to the neighbouring perfume factories. Grasse, a small town about twenty miles from Nice, is the centre of this industry. This photograph shows pickers engaged in gathering orange blossom.

Photo: The Times

made possible that golden age which bears his name, and who represents the ideal Athenian

Pericles' power exceeded that of many kings and tyrants, yet he never held the office of *archon*, which was supposed to be the highest in the state. He was simply one of the ten "generals" (*strategi*) elected each year by the Athenians to manage their affairs at home and abroad, and he owed his power entirely to his personal ascendancy and his persuasive

eloquence. His early education was supervised by the greatest teachers of the day: Zeno, the Stoic philosopher and propounder of the intriguing paradox of Achilles and the tortoise, instructed him in dialectic, that favourite study of the Greek youth ambitious to shine in high argument; and another famous philosopher, Anaxagoras, helped him to acquire that dignity and serenity of mind that marked him above all his brother statesmen in the assembly like "a god from Olympus." He ruled Athens because the Athenians learned to trust him. Under him Athens touched the highest peak of her commercial prosperity. For 30 years they re-elected him, and he made their city glorious and never failed them in times of danger or difficulty.

More than anything else, Pericles was interested in the good of the common people, although he himself was of the richest and most powerful family in all Athens. To begin with, he got the poor man enough to eat and an equal chance before the law, and then laid art and beauty open to him. The temples and statues of the Acropolis which he caused to be erected were finer than the richest man's house or treasures, and, in order that the poor man might also enjoy music and drama, Pericles saw to it that those desirable parts of a liberal education were well within reach of the poor man's purse.

Pericles came of the powerful family of the Alamaeomidae, "the most brilliant, the most

ambitious, and the most democratic of the noble families of Athens." The greatest events in Greek history took place in his lifetime. He was born about the time of the battle of Marathon (490 B.C.), and as a boy probably witnessed the battle of Salamis in which the Greek fleet defeated the host of Persian invaders. When, as a young man, he entered public life, Athens still retained the scars of these terrible conflicts. Under his patronage were produced the wonderful

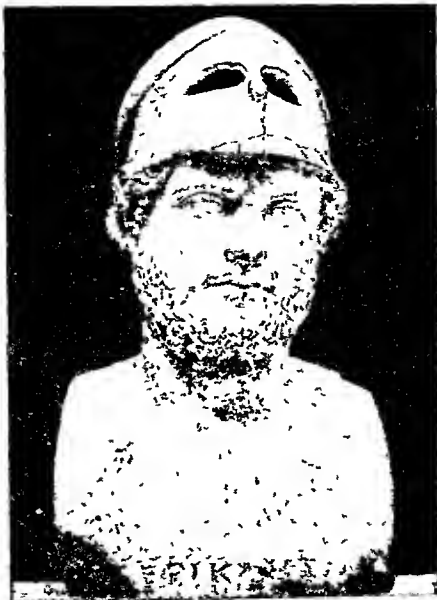
sculptures of Pheidias and the great dramas of Euripides and Sophocles.

Pericles realized his ambition to make Athens, "the queen of Hellas," not only the most beautiful but the most powerful of the Greek states. But he lived also to see the states of the Peloponnesus, under Sparta's leadership, rise against the declining power of Athens in the Peloponnesian War. The closing years of his life were times of storm and trouble. While Athens was besieged by the enemy outside the walls, a terrible plague raged within. For the first time Pericles fell out of popular favour; was deposed from office, and was even fined 50 talents on a charge of embezzlement. Only a few weeks later the people repented and reinstated him with greater powers than before. But the plague, which had made him temporarily unpopular, had left its mark on Pericles himself, and he died in the autumn of the next year.

The speeches of Pericles were not written down, but Thucydides gives us some idea of Pericles' power as an orator.

Periscope. Man's third eye, enabling him to see round a corner, out of a ditch, over the heads of a crowd, or from under water—such is the periscope, a combination of telescope and camera obscura. (See Camera.)

The periscope is used in the submerged submarine to see what is going on above the surface of the sea. Usually it is a straight,

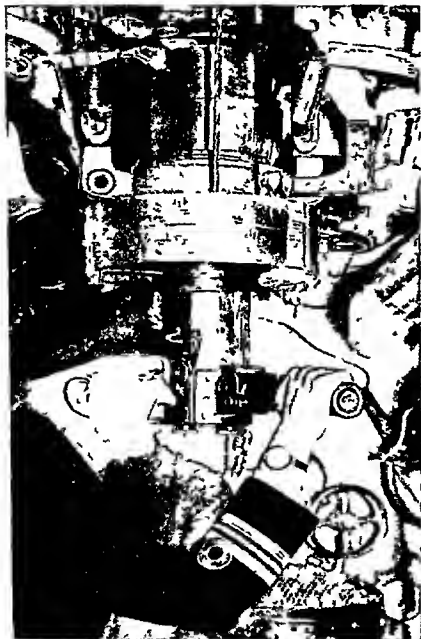


PERICLES—THE GREATEST ATHENIAN

Under the rule of Pericles, Athens reached her zenith of commercial prosperity and artistic greatness. He spent large sums on public works, and the glory of the Acropolis, including the Parthenon still dominating its height, was due to him. (British Museum photo.)

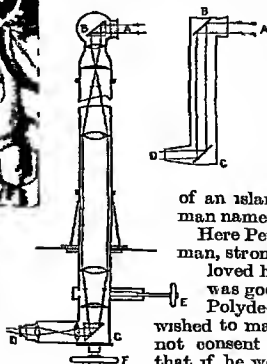
rigid, vertical pipe, some 4 to 6 inches in diameter, encased within an outer protecting pipe, and protruding upward from the interior of the submarine 20 feet or more, so that its "seeing" end is several feet above the surface of the sea. At the top and bottom are reflecting mirrors or prisms, with the reflecting surfaces parallel to each other and at an angle of 45° to the walls of the pipe.

Between the two prisms is a telescopic system of lenses which enlarges the image, sometimes to six times the size of the original picture. The scene before the top prism is reflected in it by horizontal light rays, the prism sends down the picture in vertical rays to the prism below, this converts the scene again to horizontal rays, which the observer sees.



HOW THE PERISCOPE WORKS

In the picture above the lieutenant-commander of the submarine L56 is viewing the horizon through a periscope. The diagrams show how the land and submarine periscopes work. Light passing through the window A is reflected down the tube by the prism or mirror B to a parallel one at C, and emerges at D. In the submarine periscope (left) lenses, arranged like two telescopes end to end, produce a magnified image. The valve E shuts out water if the periscope is shot away, while the wheel F rotates the whole instrument.



The eye piece near the lower end is an arrangement resembling a stereoscope, through which the commander of the submerged boat sees the scene very much as he would from a conning-tower. By means of horizontal and vertical marks on the mirror he can estimate how far any ship is from him, and its direction and speed, and he can rotate the periscope and thus scan the whole horizon. The periscope is lowered when the submarine dives or comes to the surface.

Above the sea the periscope looks like a tiny lighthouse or like a little pipe with an elbow joint, according to type. As the boat glides along under water the periscope leaves a foamy, V shaped wake—a mark which betrays the presence of submarines to the look outs on transports and destroyers during war. To avoid this risk, the periscopes can be streamlined at the top, thus doing away, to a large extent, with the tell tale wake on the water.

The field periscope, a smaller and less elaborate instrument, is used in land warfare in trenches and behind earthworks and parapets for observing the surrounding landscape without risk. (See Lons, *Submarine*)

Perseus. (Pron *pér'sūs*) Once upon a time, so the old Greeks tell us, there was a king of Argos, old and not virtuous, whose name was Acrisius. Now this king had a beautiful daughter named Danae, whom he feared, because an oracle had told him that she would bear a son who would kill the old king. So Acrisius built a tower of brass, without a door, and here he shut up the maiden. And she was lonely. But one day a shower of gold fell through the window of the tower, and in the gold was Zeus, the king of the gods, who had fallen in love with Danae. After a time she bore him a son, and named the boy Perseus.

But when Acrisius heard of the child he was very angry, and he commanded that the child and its mother be set adrift on the sea in a chest. For days they drifted, but Zeus watched over them, and the chest was at last cast safely on the shores

of an island, where a good fisherman named Dictys cared for them.

Here Perseus grew to be a young man, strong and beautiful. And he loved his mother dearly, for she was good as well as lovely. But Polydectes, king of the country, wished to marry her. Danae would not consent. Then Polydectes saw that if he would win the mother he

must first be rid of the son. So he sent Persens to fetch him the head of Medusa, thinking the lad would be killed.

This Medusa was one of three terrible sisters, called Gorgons, who had leathery wings, brazen claws, and, worst of all, writhing poisonous snakes instead of hair. They were so horrible to see that anyone who looked at their faces was turned to stone.

But the boy was half a god and the old gods helped him. Athene, the goddess of wisdom, lent him her shield polished as brightly as a mirror, Hermes gave him a magic sword and a pair of winged sandals, and Pluto the cap of darkness, which made him invisible.

Persens set out gaily, and after a long time he came to the land of eternal night, where the three Grey Sisters sat shivering and mumbling

They were so old that they hated anything young and happy, and they had only one eye and one tooth between them. At first they refused to help Persens, but the lad stole the eye as one sister was passing it to another, and refused to give it back till they had told him where he could find the Gorgons.

Then he set out again. At last he saw the three Gorgons asleep. He put on his cap of darkness and flew nearer, until he hovered over them. Alighting, he held up the shining shield, in which he saw the sisters reflected, and with a single sweep of the magic sword cut off Medusa's head, hid it in his wallet, and fled away on his winged sandals.

Presently Persens came to the kingdom of Atlas, the Titan, and asked shelter. But Atlas answered him rudely, and Persens grew angry and held up before him the head of Medusa's head, and so turned Atlas into the great mountain on which the skies rest.

After a time Persens saw that he was flying above a country that had been devastated by earthquakes and floods. And, as he flew, he saw a beautiful maiden chained to a rock beside the sea. Quickly he flew down and saw that she was weeping.

"Surely you are a king's daughter. Do they treat kings' daughters so in this strange land?"

Then the maiden answered and told him that her name was Andromeda, and that her father Cepheus was indeed king of the land. Her mother the queen had boasted that the sea nymphs were not more beautiful than her daughter. Then the nymphs were angry and complained to Poseidon, the sea-god, and he sent a great sea monster to devastate the country. The monster could only be bought off by offering him the queen's daughter Andromeda as a victim. So now she was chained to the rock, awaiting death.

But Persens feared no monster, and when the great beast came he fell upon it with his magic sword and slew it. Then he cut the chains that bound Andromeda to the rock and bore her back to her rejoicing parents. And Cepheus gave Persens his daughter's hand in marriage out of gratitude.

The hero with his bride set out for his island home, and arrived just in time to rescue his



PERSEUS DENOUNCING POLYDECTES

When Persens returned home and learned that his mother had been forced to flee to escape the violence of King Polydectes, he would have slain the king had not his mother thrown herself upon him and begged him to stop, for she feared that the people would avenge the king's death. Thereupon (so says the legend) Persens turned Polydectes and all his court into stone by showing them the head of Medusa. The island itself became stone, and the very frogs became dumb.

mother Danaë from King Polydectes, who was still troubling her. He held up Medusa's head and turned the king and court into stone. Then with his mother and his bride he returned to Argos, the land of his birth. Here he found that his grandfather Acrisius had gone to Larissa to watch the games there. So Perseus followed after, and took part in the games. As he was throwing a quoit in one of the contests it accidentally struck his grandfather and killed the old man. Thus the prophecy was fulfilled, which foretold that Acrisius should be slain by Danaë's son.

Perseus and Danaë and Andromeda lived long and happily in Perseus' kingdom, and the goddess Athene, to whom Perseus gave the Gorgon's head to fasten on her shield, befriended them always and made them wise.

RISE and FALL of the PERSIAN EMPIRE

The country formerly known as Persia is considered geographically under its modern name Iran, here is told the story of its ancient history, a tale of world shaking and world-making events

Persia. The country which since 1935 has been known by the name of Iran (*q v*) has a long and stirring history. A thousand years before



Darius the Great
British Museum

Christ it was occupied by tribes of agricultural and pastoral peoples—chiefly the Medes and Persians—whose speech was "Aryan" like our own. After a period of subjection to their Assyrian neighbours to the south-west, there came, about the year 640 B.C., a short-lived Median empire, succeeded, about 550 B.C., by a Persian empire founded by Cyrus the Great, ruler of one of the small Persian tribes under Median sway, who overthrew the empire of the Medes.

In 20 years Cyrus had extended his rule almost from the borders of India on the east to the Aegean Sea on the west, and to Egypt on the south. He was a wise ruler, whose aim was to soften by kindness the harsh rule which his sword was constantly extending. He allowed the Jews to return to Palestine, whence they had been carried as captives to Babylon, and encouraged them to rebuild their temple. When he fell in battle against a nomad tribe in 529 B.C. he was laid to rest in a tomb still to be seen near Persepolis, the ancient Persian capital.

Cambyses, the son of Cyrus, added Egypt to the immense Persian empire. To Darius the

Pershing, JOHN JOSEPH (born 1860) Born in a little shanty in Missouri, U.S.A., 58 years later commander of an army of about 2,000,000 men—that is, in brief, General Pershing's story.

After graduating from the Military Academy of West Point in 1886, he saw a good deal of active service. In 1905 he was appointed military observer with the Japanese army, a position where he could study modern warfare on a large scale. When the United States came into the World War, Pershing was placed in command of the American army.

In shaping and training this army, which quickly expanded to 2,000,000 men, he was wholly successful. His final test in the field was short, but the record of those few months has given General Pershing a high place as a commander. He retired from the army in 1924.

Great, who succeeded to the throne in 521 B.C., felt the task of organizing the Persian empire. He divided the greater part of his domains into 20 provinces, each ruled by a governor or "satrap," and each retaining a large measure of local freedom. He built roads from end to end of the empire, and also established a system of royal posts. By organizing a great Phoenician war fleet in the eastern Mediterranean he made Persia the first great Asiatic sea power.

The decline of the Persian Empire begins with Darius's attempt to conquer the Greeks and extend his power to Europe. (See Persian Wars). The great expedition of his son Xerxes in 480 B.C. suffered an overwhelming defeat in the naval engagement of Salamis and on land at Plataea.

Persia's Power Broken

Alexander the Great broke the power of Persia in the battle of Issus, in 333 B.C. The entire Persian camp fell into the hands of the conqueror, and the Persian loss in killed and prisoners was enormous. Darius III fled to Babylon, whence he sent an embassy to Alexander offering to divide his empire with him. But Alexander demanded unconditional submission, which Darius could not give. He spent two years raising a new army estimated at 1,000,000 men, but was again defeated at Arbela, and not long afterwards he was murdered by his own traitorous followers.

About a century after the death of Alexander Persia passed from the hands of his Macedonian successors into those of the Parthian kings. These were soon followed by native Sassanid rulers, of whom Chosroes II (ruled 591-628) even threatened Constantinople. Mahomedanism won



THE FAMILY OF DARIUS AT THE FEET OF ALEXANDER

At the great battle of Issus, in 333 B.C., in which the power of the Persians was broken, Darius III, king of the Persians, escaped, but his wife, his mother, his three children, his harem, and hundreds of his men, fell prisoners to Alexander the Great. The chivalry with which Alexander treated his royal prisoners was a favourite subject among later Greek writers. Painted by Charles Lebrun, the picture reflects 17th century conceptions of the classical world rather than shows what the ancients really looked like.

Persia religiously and politically soon afterwards, and Persian art and literature flourished under the Arabian caliphs.

Under the Sufi dynasty, of which Abbas the Great (c. 1557-c. 1628) was the most noted member, Persia's power and prosperity revived, and

Nadn Shah (1688-1747) even invaded India. The Kajar dynasty, which lasted from 1795 to 1925, steadily declined in power and territory, so that Persia is now a ghost of its former greatness. The present ruler of Iran, Riza Khan Pahlevi, is the son of peasants.

The Great Wars between Persia and Greece

PERSIAN WARS One of the most momentous epochs in the world's history was the second decade of the 5th century B.C., when the vast Persian Empire, then at the height of its power, attempted to carry its conquests into Greece, and thus extend Asiatic despotism to Europe. If the Persian kings had succeeded, the whole course of history might have been changed.

The first Persian monarch to proceed against Greece was Darius I (ruled 521-485 B.C.), called "The Great" for his colossal achievements in organizing and ruling the vast empire won by his predecessors. Under his rule were the cities founded by Greek colonists in Asia Minor. Some of these cities, aided by Athens, revolted, capturing and burning Sardis, the Lydian capital.

At the news of the catastrophe Darius was transported with rage. "Who are these Athenians?" he demanded. When he was told, he made a vow to take vengeance upon them, and,

according to the story, he instructed one of his servants to remind him thrice each day "Master, remember the Athenians!" He gathered an immense army to send against the Athenians, but the expedition was wrecked on the wild Macedonian coast (492 B.C.).

A second army was sent in 490 B.C. Arriving in safety, it drew up on the plain of Marathon, a short distance north east of Athens. The Athenians were brave soldiers, but they were seized with terror and despair when they looked down from the hills and saw encamped on the plain this great army that had never known defeat, flanked by hundreds of vessels drawn up in an imposing array in the adjoining bay.

Some encouragement was given by the arrival of 1,000 Greeks who came to their aid from the little city of Plataea. After several days of waiting the Athenian general Miltiades gave the order to advance.

Although their numbers were greatly inferior to those of the Persian invaders, they responded nobly to the call. Raising their war cry, they rushed towards their enemies, who looked upon them as madmen thus to run into the jaws of death. But the invaders were soon undeceived. Miltiades had drawn up his men so as to have the greatest strength in the wings, and this plan of attack completely deceived the great Darius. The Persians, as he had expected, succeeded in driving back his centre, but this was only a momentary success, for shortly after the two wings of the Greek army closed in on either side and threw the enemy into confusion. The Asiatics' line crumbled and they were driven in panic to their ships. Their loss was about 6,400 men, against only 192 on the side of the Greeks.

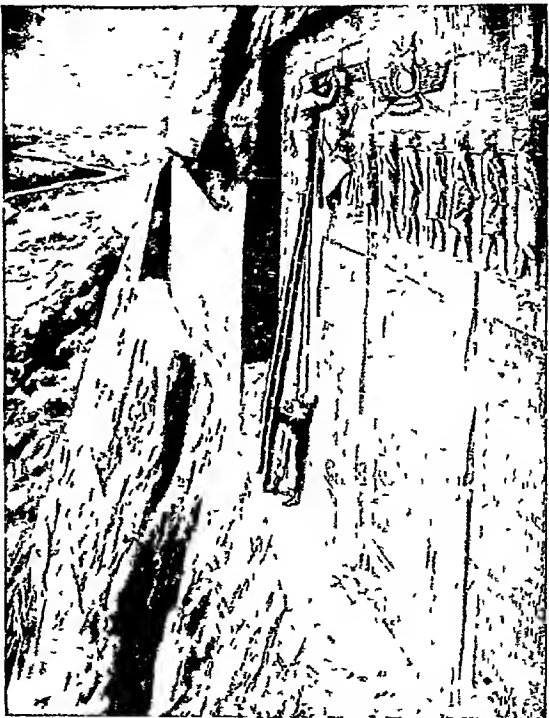
Thus ended the famous battle of Marathon, in which the Athenians for the first time averted oriental domination.

Still undismayed, Darius now began preparations for a third expedition, but before he had finished he had to turn his attention to an insurrection in Egypt. Next year he died, leaving the punishment of the presumptuous Greeks to his successor Xerxes.

Xerxes would gladly have spent his days in luxury, but when at last he decided to proceed against the Greeks, his preparations were on a stupendous scale. To avoid such a shipwreck as had befallen his father's first expedition, he caused a canal to be cut through the isthmus of Mount Athos, an undertaking which involved the labour of great numbers of men and took three years to complete. Then he had a bridge of boats thrown across the Hellespont to connect Asia with Europe. This was destroyed by violent storms, and the engineers were put to death. Two new bridges of boats were built, and at last all was ready for the passage of the great host (480 B.C.).

What a sight it must have been! The army included a medley of 46 different nations and tribes—nomad hordes of Asiatics, armed with daggers and lassoes, Libyans, wearing on their heads the skins of horses' heads, on which the ears and mane were left to terrify beholders, Ethiopians, with their

bodies painted half white and half red, men of all colours, dress, and arms, urged on by the lash of their officers. So enormous was the army, the historian Herodotus tells us, that seven nights were required for the crossing. Modern historians believe, however, that Xerxes' army could not have numbered much more than 200,000 men in all. On his way towards Athens Xerxes found a little force of Greek soldiers under the leadership of Leonidas, King of Sparta, stationed at the narrow pass of Thermopylae, which guarded the way from Thessaly to central



THE FAMOUS INSCRIBED ROCK AT BEHISTUN

In the western part of Persia above the little village of Behistun, on a precipitous cliff towering 300 feet above the ancient highway, may still be seen this immense inscription—25 feet high and 50 feet wide—recording the triumphs of Darius the Great. To enable all his subject nations to read the inscription it was carved in three languages—Persian, Babylonian, and Sutan—all in the curious cuneiform or wedge-shaped characters. Above the inscription is the figure of Darius himself, his foot upon the body of a usurper of the throne of Persia, whom he had overcome and slain. In 1855—more than 23 centuries after it was placed there—Sir Henry Rawlinson, an English officer and scholar, discovered the inscription. The perilous height was scaled and wet paper impressions or squeezes were made. After several years of study Rawlinson deciphered it thus rolling back the curtain of the past and giving the world the key to the lost language and history of ancient Babylonia and Assyria.



ATHENIAN REJOICINGS AFTER THE VICTORY OF SALAMIS

An island in the Saronic Gulf of the Aegean Sea, Salamis was the scene of a great naval victory by the Greeks over the Persians in 480 B.C. After several hours of desperate fighting the Persians were forced to flee, with a loss of 200 sail, and a whole corps of soldiers, who had been landed on the small island of Psyttaleia. The Greeks lost only 40 ships. The painting reproduced above, showing the conquerors being greeted by their womenfolk, is by Fernand Cormon, and hangs in the Luxembourg Museum, Paris.

Greece. He sent a message summoning the Greeks to deliver up their arms. "Come and take them," replied Leonidas defiantly.

In spite of their superior numbers the Persians, advancing to the attack under the lash of their officers, were held back for two days by the long spears and unbroken ranks of the Greeks. Xerxes began to despair of forcing the pass, when a traitorous Greek revealed to him a roundabout path over the mountains. When Leonidas found that the enemy were approaching from the rear and that the end was at hand, he dismissed his men except the 300 Spartans, bound like himself to remain at their post and conquer or die.

Leonidas was one of the first to fall. Around the body of their leader the gallant Spartans fought desperately, defending themselves, first with their swords, then with their hands and teeth, until in the end they were overwhelmed and slain to a man.

When Xerxes reached Athens, he found that the Athenians had abandoned the city. Their ships, which had already suffered severely in an engagement off Artemisium, were drawn up in the narrow strait between the island of Salamis and the southern coast of Attica.

Xerxes set fire to the city, and, while the flames reddened the sky, took his seat on a marble throne upon a height overlooking the

sea to watch the battle. He expected that his splendid fleet would win an easy victory, but, one after another, two hundred of the Persian ships were sunk, others were captured, and the rest turned and fled.

Leaving part of his forces in command of one of his generals, the terror-stricken Xerxes hastened back to Persia. A few months later the Persian army was scattered at Plataea. No Persian army ever again set foot in Greece, and Europe was saved from Persian domination.

Persian Gulf. An arm of the Indian Ocean, 520 miles long and 150 to 200 miles wide, thrusts up between Persia and Arabia to form the Persian Gulf. It stretches north-west from the Gulf of Oman on the south to the river Shat-el-Arab on the north, and has been of great strategic importance since ancient times. For Britain it is a strong link in the route to India. Germany coveted its control as part of her scheme for world power and the existence of rich oil-fields about its head is an additional cause of international rivalries. The outcome of the World War, however, greatly strengthened the hold of Great Britain in this part of the globe, and order is maintained under the British flag.

The Arabs called the gulf the Green Sea, from the colour given it by great numbers of tiny sea animals. The Strait of Ormuz, 30 to 60 miles wide, connects it with the Gulf of Oman, which

opens directly from that part of the Indian Ocean known as the Arabian Sea. The coast is flat and sandy on the Arabian side, high and steep on the Persian (Iranian) side. At the head of the gulf the waters of the Tigris and the Euphrates unite to form the Shat el-Arab. Since the days of the Macedonians the Persian Gulf has been noted for its valuable pearl fisheries, which today are centred principally round the Bahrein Islands (an independent Emirate under British protection), and employ thousands of natives. Most of the trade of the gulf is in the hands of Great Britain and India. The gulf has an average depth of about 200 feet.

Perspective. As you look out along a railway track, the rails, which you know are built parallel, appear to meet at a point in the distance. The trees and telegraph poles appear to grow smaller as they recede farther and farther from your eye. If you were to draw this scene just as you see it, you would be making use of "perspective," which is the art of representing on a plane surface objects as they appear to the eye from different points of view in space.

The ancient Egyptians and Assyrians knew nothing at all about perspective. The Greeks and Romans understood something of the art, but it was neglected during the Middle Ages. With the Italian Renaissance came the re-discovery and first real understanding of the principles of perspective, and, as so often happens, many painters were so pleased with their new discovery that some of their works seem almost to have been done purely to show off their skill in perspective drawing. Uccello (see p 2290), who is thought by many people to have been the real re-discoverer of the art, was especially fond of it, so was Correggio. Perspective drawing is one of the things you must master early if you are to be a great painter, unless you belong to a group so modern as to do without it! (See Drawing)

Perthshire, Scottish Co. Famous for its historic associations, Perthshire figures in

the turbulent annals of Scotland as far back as the time of Agricola in his wars with the Picts (A.D. 83). The Picts chose Scone as their capital in the eighth century, and it was long the coronation place of the Scottish kings. In 1296 the Coronation Stone was removed from Scone's ancient abbey to Westminster. Another interesting link with history, as well as with Shakespeare, is the witch-stone near Carnbeddie, where, so the story goes, Macbeth met the witches, the three "weird sisters." Many of the glens, mountains, and lakes of this beautiful inland county of Scotland have been made familiar to us by Sir Walter Scott's well-known poem, "The Lady of the Lake."

The county, which is 2,493 square miles in extent, is the fourth largest in Scotland, and is mainly mountainous, with the Grampians in the north and west, and the Sidlaw and Ochil Hills in the south and east. There are at least fifty mountains over 3,000 feet high, including Ben Lawers, Ben More, and Ben Lui. The chief river, which runs a course of 117 miles, is the Tay, the longest in Scotland. Loch Tay (14½ miles long) is the largest lake in the county. The passes of the Trossachs, Killiecrankie (where the Jacobite Highlanders under Dundee won a famous victory in 1689), and Birnam are among the loveliest in the Highlands.

The deer forests cover more than 100,000 acres, and other game is very plentiful. There is good salmon and trout fishing. Oats, barley, and other crops are grown, and sheep, cattle, and horses are raised. The county is famous for its dye works, which centre round Perth; there are flax, jute, and cotton mills, and linens, woollens, and tartans are woven.

The county town is Perth (population, 34,000), on the Tay, other important towns are Crieff, Blurgownie, Dunblane, and Auchtermoider. Holiday resorts include Pitlochry, Aberfeldy, Comrie and Callander. The population of the county is about 120,000.



PERTHSHIRE'S FAMOUS PASS

The Pass of Killiecrankie narrow and precipitous but wildly beautiful, was the scene of a famous military engagement. Through this defile the Anglo-Dutch soldiers of General Mackay passed in 1689 to meet crushing defeat at the hands of Viscount Dundee's Highlanders.

The LAND of the INCAS and its TREASURES

When the Spanish conquistadores invaded Peru they were looking only for gold and silver, but the wealth of the country today lies more in its rich natural resources of tropical products than in mere minerals

Peru. The glammers of a storied past, of fabulous wealth, of scenery romantic beyond description, of mysterious and unexplored rivers and forests, of startling contrasts of climate and topography, still make Peru a name to thrill the adventurous, as in the old days when Spanish conquistadores invaded the land in search of treasure of gold and silver.

The republic of Peru on the western coast of South America has been favoured by Nature with such a diversity of mineral wealth, soil, and climate that there is scarcely a product of any clime which cannot there be found or produced in unsurpassed excellence. But the difficulties of communication caused by the giant ranges of the Andes, the systematic oppression and the ruthless slaughter of the native population, and the incapacity of the Spanish conquerors and their descendants for the tedious and plodding labours of the pioneer have left the vast resources for the most part undeveloped. What the ruling classes of the republic have failed to do in the work of development is now being undertaken by more practical, patient, and resolute engineers of Europe and the United States. Foreign capital is flowing into the country, and foreign initiative is setting great enterprises on foot.

The traveller who has pictured the coast of Peru as covered with tropical vegetation is astonished to find there an arid, dreary, treeless coast strip, 20 to 30 miles wide, save for a few green river valleys at wide intervals. Rain rarely falls in this region, for the towering summits of the Andes intercept the moisture-laden trade winds from the south-east

Area—From 482,000 to 524,000 square miles (figures uncertain owing to boundary disputes) Population estimated at 6,000,000

Physical Features—Three well-defined regions: the coast of sandy desert, bordering on Pacific, the "sierra" region of the Andes, with immense mountain ranges, and the "montaña" region of tropical forests within valley of the Amazon. Three great navigable rivers—Marañon, Huallaga, and Ucayali. Largest lake, Titicaca.

Principal Products—Silver, copper, coal, iron, sulphur, vanadium, and petroleum, rubber, quinine, cotton, sugar, coffee, wool, hides, and skins.

Chief Cities—Lima (capital, 500,000), Callao (75,000), Arequipa (46,000), Cuzco (40,000).

and the fall is all on the eastern slopes.

Peru falls naturally into three zones: the coast zone, the "sierra," or great tableland, lying in the valleys between the three ranges of the Andes, and the "montaña," or river and forest zone, on the eastern slopes. These

three zones differ so widely in climate, products, and population that they form, in effect, worlds to themselves, and the differences are made greater by the difficulties of communication, for many of the upland cities are accessible only by rough and precipitous mule tracks, while the huge forest region has no routes of travel except the waterways. The coast zone comprises about one-tenth of the total area. The sierra occupies about a fourth part, and the forest zone the rest.

Boundary disputes with her neighbours make this area of Peru uncertain, but, including the regions to which her claim is strongest, the area is about 524,800 square miles. An enormous river system, perhaps the most remarkable in the world, breaks through the eastern chain of the Andes and flows through impenetrable jungles to form the Amazon. Of these rivers the greatest is the Marañon, which almost touches Ecuador and flows into Brazil, and is generally taken to be the true source of the Amazon.

The coast towns, with the valleys of the few rivers that flow into the Pacific, are the centre of the commercial, intellectual, and political life of Peru. Irrigated stretches are grown sugar and cotton, with rice, tropical fruits, and vineyards. Of the 50,000,000 acres available for cultivation along the coast only a fraction is productive because of the lack of irrigation.



PERUVIAN PIPES

More than half the people of Peru are pure Indians, who still speak Quichua, the language of the Incas. They are a gentle, melancholy, and somewhat apathetic race. Even their music, played on simple musical pipes like this, is, as one might expect, rather thin and doleful.

PERU

The plateaux and valleys of the sierra, with their more bracing climate, contain a great extent of fertile soil, but much of it can be cultivated only by terracing the steep hill-sides as did the ancient Incas. Coffee, maize, wheat, barley, potatoes (which came originally from this part of South America), alfalfa, coca (a shrub from whose leaves cocaine is extracted) flourish at various levels from 5,000 to 12,000 feet. Through the entire length of the sierra region are immense grazing lands, on which cattle and sheep are raised, as well as flocks of alpacas and the most useful of all the Andean animals, the llamas (See Lluma). The wool of these animals furnishes much of the clothing of the country and is also exported in considerable quantities.

On the temperate eastern slopes of the Andes and in the tropical river valleys abundant harvests of almost every known crop could be raised in a remarkably short time but the difficulty of transport greatly retards development. The forests of valuable woods in this district cover two thirds of the entire area of Peru. The rubber forests appear inexhaustible, but are difficult of access. Another famous product is quinine made from the cinchona tree, also called "Peruvian bark."

The mountains contain mineral deposits of great variety and extent. Copper, silver, coal, iron, quicksilver, lead, sulphur, zinc, and many rare metals are found in abundance. The production of petroleum, which is found near the seashore, is growing.

To open up these enormous agricultural and mineral resources, transport is the principal thing needful. It now takes a journey of 17 days by rail, mule track, and water to go from the capital, Lima, near the coast, to Iquitos, near the source of the Amazon—1,224 miles.

The various short railways of Peru total about 3,000 miles. The 4,000 miles of waterways, navigable for vessels of 8 ft draught, and the familiar pack trains of mules and llamas



PERU—BETWEEN THE PACIFIC AND THE ANDES

Peru's boundaries with her northern neighbours have long been in dispute. The boundary with Colombia was settled by an agreement which gave Peru all the territory south of the river Putumayo.

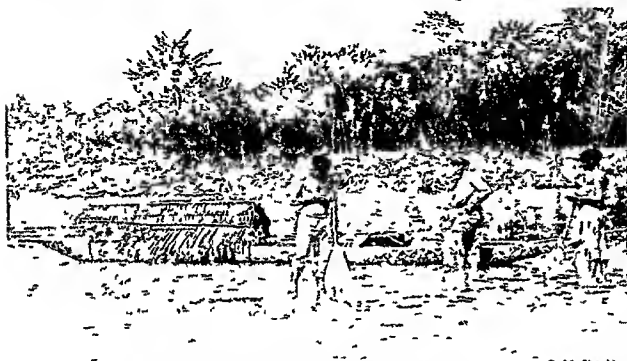
were till recently the only other means of transport, but a highway system is being developed and air travel is increasing. Between Peru and Bolivia on Lake Titicaca steamers navigate at the highest elevation in the world.

Sugar and cotton rank first among the manufactures. High-speed mills, which are replacing the old machinery in the sugar factories, are greatly increasing production. The cocaine from Peru largely supplies the world's demand.

Lima, the capital and largest city, manufactures cotton and woollen textiles, sugar, cocaine, and tobacco (See Lima). Arequipa,

the second city, has cotton and flour mills, chocolate factories, and leather manufactures. The chief ports are Callao and Mollendo in the south. From Paita is exported the petroleum of northern Peru. Cuzco was the chief city of the Incas, who obtained gold from the mines and steam grates in the region. Cerro de Pasco, about 100 miles north-east of Lima and rising to more than 14,000 feet, is one of the highest and greatest mining camps in the world. Copper has now replaced silver as the chief mineral of this district.

It is estimated that more than half the population are pure Indians. The whites compose about 13 per cent, 25 per cent are of mixed blood, and there is a sprinkling of negroes, Chinese, and Japanese.



PRIMITIVE TRANSPORT IN PERU

Thousands of miles of waterway traverse the Montaña of Peru. Most of it is navigable by canoes, and this is fortunate, for in most places the canoe is the only means of transport. Here is a typical Indian dug-out canoe, in the navigation of which by means of paddles the natives are experts.

Peru contains many interesting remains of ancient Indian civilization. (See Incas.) Buildings of immense size, and beautiful pottery and implements, testify to the high degree of development it had attained.

From its conquest by Pizarro (qv) in the 16th century until its declaration as an independent republic in 1821, Peru was rather ruthlessly governed from Spain. In 1824 a liberating army from Colombia, under General Simon Bolivar, finally rid Peru of Spanish rule. Later, in 1844, a stable government was set up.

In 1879 Peru, as an ally of Bolivia, became involved in a war with Chile. Peru was defeated, and lost the province of Tarapaca, also the possession of Tacna and Arica. In 1929 an agreement was made whereby Chile kept Arica and the Arica-Tacna railway. Peru received Tacna, with port rights in Arica.

Peru is a republic with a centralized government. The President, who holds office for five years, and the members of the Senate (40 members) and House of Representatives (140 members) are elected by popular vote. Only males over 21 years old, who can read and write, are allowed to vote. The President is not eligible for re-election until a period of five years has elapsed. The Roman Catholic faith is the State religion. There is a State system of compulsory and free education.

Peter, SAINT "Follow Me, and I will make you fishers of men," said Jesus to the two sturdy fishermen on the Sea of Galilee, Simon called Peter, and Andrew his brother, and without hesitation they rose, pulled their nets into the ship, climbed over the side, and went with Him. They knew Him, having seen Him in the crowd that gathered to listen to the great preacher, John the Baptist.

Peter became the most prominent of the Twelve Disciples. With James and John he formed a little intimate group around Jesus, and with them was present at some of the great incidents of Jesus' life.

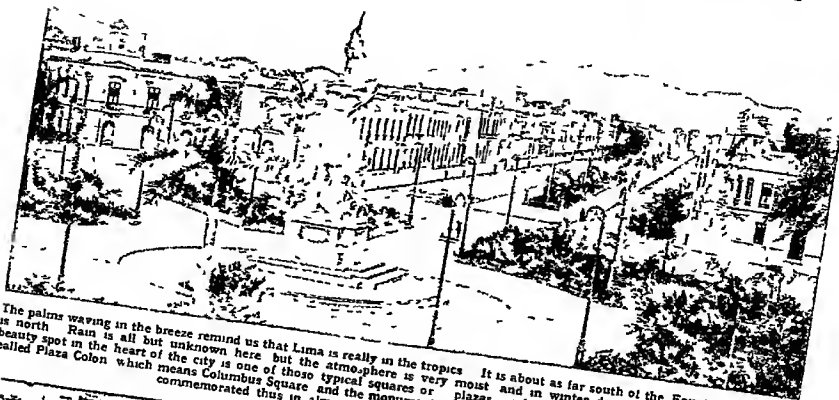
It was St. Peter, according to the gospels of St. Matthew and St. Luke, who first gave voice to belief in the divinity of Jesus—"Thou art Christ, the son of the living God."

Peter was generous hearted but impulsive, and the Gospel according to St. John says that it was he who, when men came to arrest Jesus, lifted his sword, and smote wildly at the man nearest him,

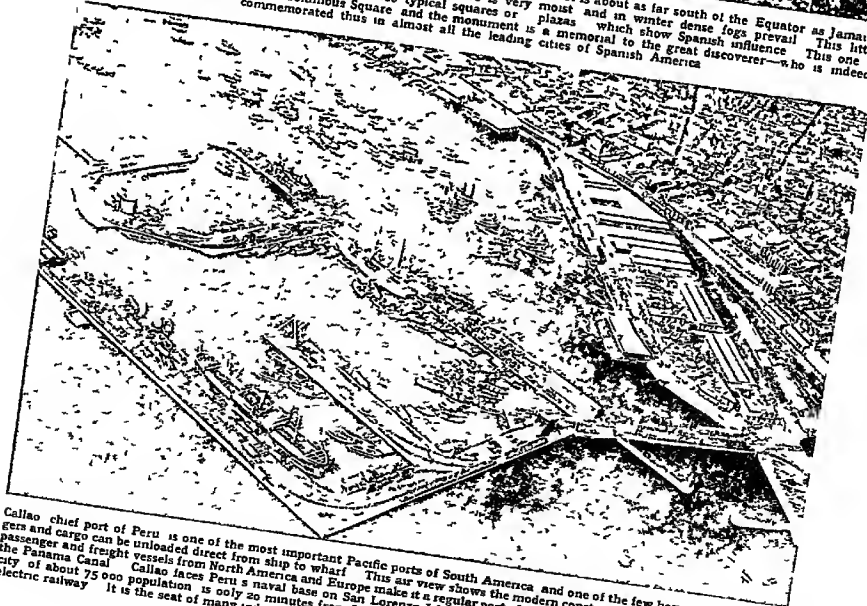
cutting off his ear. Yet only a few hours afterwards, when Jesus had been led off to the house of the high-priest, Peter denied that he had ever known Him. Later he bitterly repented his denial. Christ appeared to him after the Resurrection and gave him the command, "Feed My sheep, feed My lambs."

Peter, thus assured that the Master still trusted him, grew daring and courageous, and became the great teacher in the early days of the Church, preaching throughout Palestine, performing miracles of healing, and enduring great hardships and persecution. That he worked in Rome for a time is accepted by Catholics and many leading Protestant scholars. Catholics count him as the first Bishop of Rome and the first Pope. His claim to the position of head of the Church is based on the words of Jesus to Peter: "Thou art Peter, and upon this

PERU'S CAPITAL CITY AND ITS CHIEF PORT



The palms waving in the breeze remind us that Lima is really in the tropics. It is about as far south of the Equator as Jamaica is north. Rain is all but unknown here but the atmosphere is very moist and in winter dense fogs prevail. This little beauty spot in the heart of the city is one of those typical squares or plazas which show Spanish influence. This one is called Plaza Colon which means Columbus Square and the monument is a memorial to the great discoverer—who is indeed commemorated thus in almost all the leading cities of Spanish America.



Callao chief port of Peru is one of the most important Pacific ports of South America and one of the few havens where passengers and cargo can be unloaded direct from ship to wharf. This air view shows the modern construction of the wharves. Large passenger and freight vessels from North America and Europe make it a regular port of call; those from the Atlantic come through the Panama Canal. Callao faces Peru's naval base on San Lorenzo Island and is the home port of the Peruvian navy. The city of about 75,000 population is only 20 minutes from Lima by car and it is also connected with the capital by steam and electric railway. It is the seat of many industries and business establishments, and is frequently called down-town Lima.



CHRIST'S CHARGE TO ST PETER

Peter, the fisherman, when he had abandoned his nets and become a "fisher of men," was one of the most prominent of Christ's disciples. When, after the Resurrection, Jesus came to the disciples on the sea-shore, He charged Peter to feed His sheep, an incident depicted in this engraving.

Engraving by F. Keller after painting by F. Overbeck

rock (the Greek *petros* means 'rock') I will build My Church." (See Matthew xvi, 18)

After many years, according to tradition, the Romans took him prisoner in the reign of Nero and crucified him. Peter, impetuous as of old, declared he was not worthy to be crucified as his Master was, and asked to be crucified head downwards, a request which the Romans readily granted. St Peter's in Rome, the largest church in Christendom, is named after him, and in it is his great bronze statue, some 1,500 years old, the big toe of which is reverently kissed by Catholic visitors.

Peter is credited with two Epistles, letters written to the Christians in various provinces of Asia Minor. It is believed that the Gospel of Mark is derived from Peter's accounts of the life of the Master.

Peter the Great (1672-1725) Russia has two faces: one is turned towards Asia, with the other it looks out on Europe. Its western face has never lost the features given it by the greatest of the Romanoffs, Peter the Great.

In Europeanizing Russia, Peter owed something to his predecessors, who had made contacts

with the western world and permitted traders and colonists to come into Muscovy, as Russia was called, and to settle in the outskirts of Moscow itself. It was to these colonists and to his French tutor that the boy Peter, neglected at Court, turned for knowledge in the reigns of his older half-brother and sister.

In 1689 the ruthless boy of 17, already a man in energy and decision, shut up in a convent his half-sister, Sophia, who had been acting as regent, and disregarded his feeble-minded half-brother, Ivan, who was supposed to be joint ruler with him. It seemed nothing short of insanity for a ruler to attempt to beat down the walls of tradition that shut Russia off from the Europe of Louis XIV's day. But Peter did it almost single-handed. Brutal, barbaric, without scruple, without even a memory of kindness or conscience or morals, he whipped Russia into a place among the European powers.

Nothing could stop this volcano of human energy, and he stopped at nothing to gain his ends. It was as if he was driven by an inner fire, and his activity was unceasing. He reformed the army, began the navy, crushed the Church into subjection, introduced new taxes, forced European ways and dress on his reluctant nobles, furthered the introduction of western education, products, and processes, and sent Russians abroad to learn, while he brought in western Europeans to teach.

Peter not only drove but he led. He tried to learn everything himself. In 1697 he visited Europe, ostensibly as a subordinate member of a group of Russians who were to learn western ways. Prussia, Hanover, Holland were visited, and in the last country, as well as in England, the Tsar himself worked in a shipyard. Three months were spent in England, and several hundred English engineers and artisans were added to the party. When the Russians left, the English cleared out the residences assigned to them much as they would clean a pigsty.

Louis XIV of France avoided such a visitation by insisting that, as Peter was travelling incognito, he could not give him a royal reception. Peter, therefore, travelled on to Vienna, whence he was recalled by a plot of the royal guard (*Strzyella*) aided by the Old Russian party. After crushing the rising Peter divorced his wife Eudoxia, who was thought to be in the plot.

Peter's reforming zeal led him to extremes. As it was unusual for the inhabitants of western

THE CREATOR OF THE OLD RUSSIAN EMPIRE



Dudley Tennant

Brutal barbaric and entirely without scruples Peter the Great Tear of Russia performed the well nigh impossible feat of beating down the walls of old tradition and whipping Russia into a place in the circle of European powers. To accomplish this he had to secure an ice free seaboard and to create a fleet. In 1721 Peter succeeded in obtaining a practicable shore line on the Gulf of Finland and as to a fleet he himself learned how ships should be built by working in the dockyards at Deptford and on the Continent.

Painted specially for this war! by DUDLEY TENNANT

A MODERN LANDOWNER WOULD THROW HIM OUT!



When Peter the Great visited England in 1697 he leased Sayes Court, the estate of Sir John Evelyn at Deptford, which was near the shipyards. Peter did much damage to Evelyn's gardens, which were among the most famous in England, and made it one of his chief amusements, so it is said, to ride in a wheelbarrow through a thick holly hedge which had been Evelyn's special delight. What did the Czar of all the Russias care about a garden?

countries to wear beards, he issued a decree that Russians must be shaved, and turned harsher by cutting off the hair from the chins of some of his subjects. If a man particularly wished to retain his beard he was allowed to do so on payment of a tax, a receipt for which in the form of a disk had to be attached to the beard. As wigs were in fashion in the West, his officials had to wear them.

In his external policy Peter determined to secure for Russia ice-free outlets to the sea which he called "windows towards Europe." His first blow fell on Turkey in an effort to secure a foothold on the Black Sea. In 1696 he captured Azov, at the mouth of the Don, only to lose it 15 years later.

In the meantime he had challenged Sweden, the greatest military power of the north, which in that day controlled the eastern end of the Baltic. Russia's only possible outlet. From 1700 to 1721 it was a duel between Peter the Great and Charles XII of Sweden. Peter's raw recruits were beaten at first, and Charles declared that "there is no pleasure in fighting with the Russians, for they will not stand like other men, but run away at once," but they and Peter learned by experience. At the battle of Poltava (1709) Peter won a decisive victory. The war continued, each leader drawing to his support the other's enemies. Finally Peter triumphed, and by the peace of Nystadt, in 1721, Russia became a Baltic power, with a shore line on the south of the Gulf of Finland. A year later a war with Persia gave him a foothold on the Caspian Sea.

In 1712 he married again, and on his death in 1725 his widow, the daughter of a peasant woman, became his successor as Catherine I. Probably no ruler has ever left a greater impression on the land over which he ruled than did this Tsar, half brutal barbarian and half benevolent despot.

Peterborough. When you travel by train from London to Scotland by the East Coast route, the first really important station reached

is that of the city of Peterborough, and, if you should be motoring north via the Great North Road, the city lies only a few miles to the east through the Northamptonshire countryside.

The city, which has a population of 43,000, stands on the river Nene. Its industries include the making of railway rolling-stock and agricultural implements. The cathedral is a pleasing mixture of several styles of architecture, particularly notable is the fine west front. Catherine of Aragon is buried here. The Soke of Peterborough, a district around the city,

forms a separate administrative division within Northamptonshire.

Petrel. 'Mother Carey's chickens,' as the stormy petrels are called by sailors, wander over the North Atlantic. They live almost entirely on the sea, coming to shore only for a brief nesting season. Following every ship, weathering every gale, these strong-winged little birds are known to all seamen, who do not always regard them with favour, believing that their appearance presages a storm, hence comes the name of a common species, the stormy petrel.

The name petrel means "little Peter," and it was given to these and similar birds because their habit of "walking on the water" recalls the Biblical story of the Apostle Peter. The birds, however, always do their "wave walking" upheld on spread wings, and the feat can scarcely be called

walking in the strictest sense. Strange stories and superstitions are connected with the petrel. They are supposed by many to be under the protection of the Virgin Mary, and each bird is believed to represent the soul of a sailor who was lost at sea.

Petrels vary much in size, from the stormy petrel (*Hydrobates pelagicus*), which is 5½ inches in length, to species whose wing span is several feet. Generally but one egg is laid, in a rocky crevice or in a burrow in some bank. Owing to the weakness of their legs, due to the fact that they never use them for walking, these birds have lost the power of even standing erect. They rest more or less sitting down, and shuffle



PETER, RUSSIA'S GREATEST TSAR

Peter the Great is here seen from a painting by Repin. The famous reforming Tsar lived on a grand scale like one of the heroes of the ancient world, and Russia is his monument. He enforced vast constructive reforms, and strove to transform Russia from an eastern into a western state.



PAIR OF PETRELS

The stormy petrels are the species illustrated here. One of the smallest of our water birds, the petrel cannot walk, and flies directly to and from its nest. They can eject an oily fluid from their bills to a considerable distance.

clumsily to and from their nests. The birds feed on small water animals or on refuse from ships.

There are about 100 species of petrels, most of which frequent the Antarctic Ocean, and all belong to the order of tube-nosed swimmers (*Procellariiformes*). Besides the stormy petrel, we have in Britain two other members of this order, the fulmar and the Manx shearwater. The fulmar is a medium-sized, gull-like bird, grey and white in colour, but far more graceful and powerful in flight than any gull. It is found on rocky coasts in Scotland and the north of England. The Manx shearwater is a curious little bird with a longish beak, but otherwise much like the petrel. It is extinct in the Isle of Man, but breeds in some localities round the Irish Sea. These birds are on the wing at night, often far out at sea, making a noisy chattering as they go. In the daytime they stay at home mostly, often hidden away in burrows in the turf of the cliff-tops, in crannies of the rocks, or in other holes. On the wing, it excels even the fulmar in grace and skill.

Petrol. The petrol-station is a recognized feature of our landscape, and there are few parts of Britain where you cannot get your car-tank filled with "juice" at all hours of the day—and in many places at night, too. You just drive up to the pump, the attendant puts one end of a long pipe in your tank, and turns a handle, the petrol pours in, and after paying you drive away. Yet only a few years ago every motorist always carried a spare can of petrol for fear of being "standed."

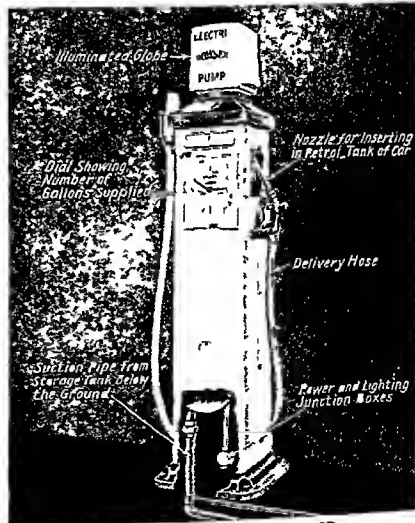
The petrol-pump, indeed, is one of the most remarkable examples of modern organization.

Only about half the money paid for petrol goes towards its actual cost, the rest is passed on to the Government as tax. Thus, petrol is

not so expensive as one might suppose. Indeed, considering the vast organization necessary for its distribution, the constant research and analysis required to keep the standard constant, the tremendous distance it has to come from the oil-well, the intricate processes of refining, and the services of the man at the pump—petrol is a remarkably cheap necessity.

In deciding which grade of petrol to buy we naturally consider the price per gallon. Petrol varies in quality, and the dearer petrels are not necessarily the best. There are other important factors to be considered in choosing a petrol. For instance, which kind of petrol will enable our car to travel the largest number of miles per gallon? This is a big question to ask, and in order to answer it we must look back over the history of petrol and car engines.

In the older petrol engine the vapour in the cylinders was compressed to a quarter of its volume before being ignited. Higher compressions would give more power, but could not be used, because the vapour exploded too soon and kicked back, or "knocked." In 1922 it was found that adding a little tetra-ethyl lead and some ethylene bromide to petrol permitted several times the usual compression without



ELECTRIC PETROL PUMP

A feature of the rapid growth of motor transport is the multiplication of petrol-stations, where the motorist can "fill up" at any time of the day or night. Here you see the Bower "Robot," an electric pump which delivers fuel to the car from the underground storage tanks of the station.

Courtesy of S. P. Bower & Co. Ltd.

knocking. Doped, or "ethyl," petrol was first marketed in 1923.

In 1930 engineers adopted the octane number test for rating the anti-knock quality of fuels. Two test hydrocarbons are used. One, heptane, knocks violently. The other, iso octane, can scarcely be made to knock at all. The fuel to be tested is used in an adjustable engine until it begins to knock. Then a mixture of heptane and iso octane is found which matches the fuel in knocking. The percentage of iso octane in the mixture is called the octane number of the fuel. The higher the octane number, the more compression the fuel will stand without knocking.

Refiners soon learned to improve the octane-number ratings of ordinary petrol. In 1933 they arranged with the patent owners to use ethyl in ordinary grades, provided these were kept about five octane numbers below ethyl grades. Benzole, which has high anti knock properties, is also used in petrol.

These modern fuels make possible compression ratios of over 6 to 1 in motor car engines. Aviation fuels, up to 100 octane number rating,

used in high compression engines, enable modern aeroplanes to fly with heavy loads at what was once racing speed.

Another important factor in choosing a petrol is the ease with which it will make an engine "start up" on a cold morning. Generally speaking, fuels with a high octane number have a low volatility, which means that the petrol will not vaporize easily in cold weather. So some firms put two grades of petrol on the market, one for winter and one for the summer. The winter petrols are treated with "casing-head" or "natural" gas (see Oil) in order to make them more volatile. This gives better starting in cold weather. A winter grade used in the summer might vaporize too easily and form an "air lock" in the pump or petrol pipe.

Petroleum. The term "petroleum," which means "rock oil," is applied in some countries, particularly the U.S.A., to crude mineral oil, the raw material from which paraffin, petrol, lubricating oil, and other oil products are manufactured. In this work these are described under the heading Oil. (See also Petrol)

HOW to LOOK AFTER your PETS

Mere kindness is not enough when dealing with animals and birds, it must be prompted by knowledge and not sentiment. This article tells you how to keep your pets healthy and happy sensibly.

Pets and THEIR CARE A well cared-for pet is a source of constant pleasure to one who loves animals. Gentleness and attention

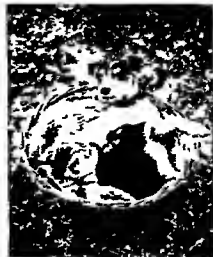


Photo Dr. Leonard H. Snowball

are the two means of winning the love and confidence of any pet, and there is a heart-satisfying happiness in the feeling that some dependent creature looks upon you as the kindest being in the whole world.

Veterinary surgery is a very important profession these days. A boy who wants to be a qualified "vet"

must undergo training at one of the schools attached to the Royal College of Veterinary Surgeons. Many animal-loving girls now enter the same profession, or become kennel maids, etc.

Apart from this professional interest in animals' welfare, everybody who has a pet must be interested in their health.

The following rules should be adopted strictly in caring for any pet. (1) It should be fed regularly, (2) its living quarters should be kept clean and sanitary, (3) it should have

constant access to fresh water, (4) with the exception of cats and dogs, pets should be handled only when necessary or after they have gained enough confidence to invite caresses, (5) the habits of the pet should be studied, and it should be given its natural surroundings as nearly as possible, and its individual tastes should be considered and gratified.

There are at least 50 different kinds of animals and birds kept as pets. Of these, we have space for the discussion of only a few.

Dogs Most dogs should be cared for as follows. If he sleeps in a shed or some part of the house, see that his bed is kept dry and clean, if a kennel is used, it should be well ventilated and built so that it can be cleaned and aired when not in use, the interior walls should be whitewashed or painted with creosote.

The dog should always have access to plenty of fresh clean water. Many dogs are overfed. Two meals a day, breakfast and supper, are enough. The diet should be varied. Cooked or raw meat may be given in small quantities, and cooked vegetables should be given at least twice a week. For breakfast, give a handful of dog-biscuits at the most.

The food does not need to be too warm, and should not be hot or sloppy (except for very young puppies, which need a special diet). For the evening meal, give a mixture of

vegetables and cooked meat, one-fourth or less of meat to three-fourths of bread or vegetables. The dog should have bones to gnaw, but never the bones of game, fish, or chicken. The drinking-dish should be filled with fresh water every day. The dog should never be fed at the table or at any but regular hours.

The dog should be washed only very occasionally. The water for the bath should be tepid, no water should be allowed to get into the ears. Grooming with a brush and comb should be done every day. When necessary, give olive oil or small doses of castor-oil. Exercise is as necessary as food to a dog and when a big dog is kept in the house most of the day it should be taken for a long run last thing at night, and a long country walk at week-ends. It is usual for most dogs to have their coats "stripped" every year before the hot weather.

It is the greatest cruelty to keep the average dog on the chain in the daytime. Terriers and bigger dogs that can look after themselves should be trained to go out and have a run on their own. Smaller dogs, like Pekinese, have to be accompanied and often kept on the lead when they are in the streets. A most important part of a dog's training is to make it obey immediately when out for a walk. (See also the separate article on the Dog.)

CATS Nearly everyone keeps a cat, but, though it is very easy to look after, many people fail to care for their cat properly. It is a very simple thing to train a kitten into a thoroughly well-behaved cat. Cats like to have their liberty, and to be free to go in and out of the house whenever they wish. Yet this liberty can be combined with discipline.

A good cat, kept in an ordinary house, should be provided with a cushion to sleep on, placed in some corner that is reasonably free from draughts. Cats often get into trouble for going to sleep in armchairs when they are not supposed to, although they have done so only to get away from the draughts on the floor. Placing the cat's cushion in a box makes a comfortable bed for it to sleep on.

A cat's favourite foods are, of course, milk and fish, but never give a tiny kitten pure cow's milk—it is much too strong and should be diluted with warm water. Cats frequently show fondness for different kinds of food. Some are very fond of potatoes, others like bread and gravy, and a great many welcome a "breakfast" of porridge.

If a kitten or a cat uses its claws on a young child, it is nearly always the child's fault for not leaving it alone, although in most cases pussy is blamed and punished for being "spiteful".



BIRD AND BEAST IN PERFECT HARMONY

In wild life, birds and beasts seldom agree, but these pictures show how Nature can be altered by bringing different creatures up together as pets. Above, a collie dog has as its friends two young tawny owls, taken from the nest as mere fledglings, while below, even more remarkable, a kitten has foregathered with a budgerigar, although cat and bird are traditional enemies.

Photos top J. T. Roberts bottom G. A. Shaw

when it is really nothing of the kind. Every child must sooner or later learn how to treat animals properly, and a scratch from puss is perhaps the best way of teaching them!

GOATS The goat is a very useful animal. Its ancestors lived in high mountains, therefore it is a successful climber, and has learned to feed up on anything it can find. The pet goat

SOME INTERESTING PETS OF THE OUT-OF-DOORS



Pets can mean far more to children than "something to play with." Taking care of animals encourages the natural growth of a child's sense of kindness and responsibility. And many a useful hour may be pleasantly spent in learning to build pens, feeding troughs and other things that suggest themselves to the pet owner. The two boys in

the upper picture, for example, built that wagon for their goat. Children who live in the country find goats amusing pets—intelligent and easy to feed. Below a boy and his sister are not only having a lot of fun looking after the welfare of their rabbit family, but are also learning in a simple, natural way a good deal about the mysteries of life.

should have a warm, light stall, with plenty of dry bedding, and the place should be cleaned often. Dryness is essential if a goat is to keep well and healthy. (See Goats)

The goat must have plenty of fresh air and exercise to keep it healthy. Its food when it is in its stall should be clover hay, with oats, and bran. It likes plenty of salt, and must all the time have access to fresh water. If housed in winter, it should be given twigs of hazel to browse upon to keep it employed. A goat should never be teased. It requires green food, and is very fond of the hearts of cabbages, so must be kept out of the garden at all costs. A goat must be groomed frequently with a stiff brush, to keep its coat in good order.

RABBITS Pet rabbits should be kept in boxes or hutches so built as to protect them from rain and cold. The hutch should be well ventilated and easily cleaned, and can be placed in a shed open in front or on a platform in the garden.

An ordinary hutch for one rabbit should be at least three feet long and a foot and a half wide and high. The ends must be draught proof and the floor raised above the ground. A sleeping apartment should be partitioned off at one end, the hutch should be bedded down with sawdust and the sleeping apartment furnished with clean, fresh straw or hay.

Rabbits and hares are vegetarians. Their chief food should be hay, clover, oats, and bran, and green food, such as grass, clover, cabbage, and roots, especially carrots. The oats, bran, or meal should be damped but not sloppy. Food should be given in vessels that have edges turned inward so that it cannot be scratched out. These pans must be kept clean. Water should be given in a vessel fastened to avoid spilling.

When handling a rabbit do not lift it by the ears alone, clasp the ears firmly with one hand and support the animal's weight with the other

GUINEA-PIGS These animals came from South America, where there are many species, varying in size from that of a mouse to that of a half-grown pig. They are rodents and have nothing whatever to do with pigs.

The guinea-pig should be kept in a hutch inside a house or shed, for it cannot endure cold. An inverted box, 1 ft square, with a 6 inch hole out in the side, makes a good nest for one guinea-pig when filled with straw or hay. These

animals live exclusively on vegetable food—fresh grass, lettuce, celery leaves, beet tops, water-cress, dandelions, and parsley, with apples now and then. A constant supply of carrots ensures good health. Whole or rolled oats may be given, and plenty of fresh water must be supplied. The long-haired varieties must have their coats brushed often.

WHITE RATS, MICE, FANCY MICE In general, the treatment of all these should be the same, except that rats must have a larger cage. A box with a lid and one side covered with wire screen, with a floor area of 12 by 24 inches for a pair of rats, and 12 by 6 inches for a pair of mice, will do. It may have a slit at the bottom along one side, which can be opened to clean the cage with a soreraper. A movable nest-box, with a lid and a hole in one side, may be attached to one side of the cage or put in a corner on the floor. The cage and nest-boxes should be cleaned with soap and hot water and thoroughly dried before being used again. The bedding may be sawdust or layers of paper, the nest-box should have paper in fine strips. This bedding should be cleaned out and renewed at intervals, although that in the nest-box will probably have been woven into a nest of some sort and is then of course best left alone. In the case of rats the whole box should be strongly built.

Rats are fed on hard-boiled eggs, crusts, table scraps, and carrots. Mice eat canary seeds, oats,

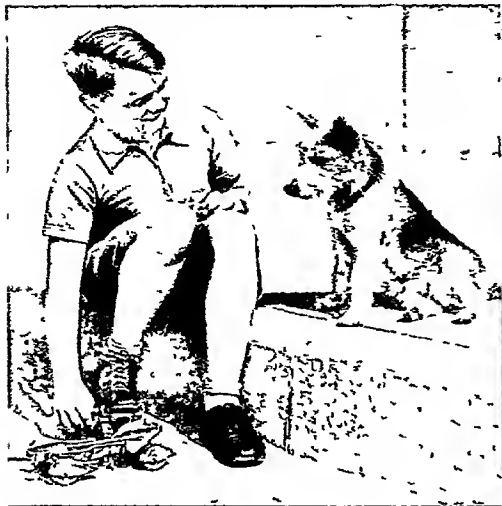


PETS IN A BRISBANE GARDEN

This Australian lady has some unusual pets, for they include two little koala bears, as well as a wallaby, to say nothing of a fine Alsatian dog. Many wild animals are easy to tame if caught young, but in Britain we seldom have room for such pets as these, or the opportunity to keep them.

Austral News and Picture Service

TOWN, HOUSEHOLD & PLAYGROUND COMPANIONS



For children who live in the city, dogs and cats are the most practical pets. And by having one of each in the house, the children soon learn that the supposed instability of cats and dogs to get along together usually turns out to be a myth. At the upper left are two real friends—a boy and his wire-haired terrier—united by mutual affection and

loyalty. The smaller boy at the right finds in his cheerful kitten a companion to care for and protect. Below, the situation is reversed. The young clown is a watchdog ready to protect his small playmate sitting on the porch in the sun. Most dogs are excellent guardians for the household and really earn in this way much more than their keep

stale bread or dog-biscuit soaked in milk, apples, carrots, grass heads, and dandelion leaves. Neither rats nor mice should be given sugar, salt, or cheese. They are very thirsty animals, and must be provided with water at all times or they may kill one another.

Mice should be provided with a play-house in the cage. One kind can easily be made by taking a wooden box, without a cover, about 3 inches square and 2 inches high. Cut holes $1\frac{1}{2}$ inch wide down the sides of the box opposite each other. Invert this box in the middle of the cage, and the little creatures will run in and out through the openings for hours.

CANARIES The canary is often treated cruelly without intention. Usually the cage is too small. It should be at least 18 inches long and high accordingly. The perches should be rounded and of different sizes, to rest the bird's feet, and should be placed so as not to interfere with its exercise. The cage should be hung where there is plenty of light, but not in a draught or near a gas jet. The cage should be cleaned at least every other day, and fresh water for drinking given every day.

A mixture of canary grass, millet, rape, and hemp is the standard food. A little green food should be given occasionally. Give them chickweed, lettuce, and plantain seed stalks in the summer, and apple in the winter. Dry bread soaked in milk may be given for a change. A

cuttle fish bone should always be present as an aid to digestion, it should be changed every three months. Sand should be scattered on the floor of the cage. A chance to bathe once a week should be given. During the moulting season the bird should be given hard-boiled egg chopped fine with an equal amount of bread crumbs, mixed with a teaspoonful of cayenne pepper, in addition to the regular diet. Almost all canaries are very fond of sugar, and a little lump may



FAVOURITES IN THE PETS' CORNER AT LONDON'S ZOO

First opened to the public in 1935, the "Pets' Corner" or "Children's Zoo" at the London Zoo was an immediate success. Here children, and grown-ups as well, can become familiar with all sorts of strange pets, as these photographs show. In the top picture George, the baby lion cub, is the centre of interest, while below a young visitor has a strange pair, a lamb and a penguin.

Photos: top Sport & General; bottom Fox Photos

be stuck between the wires of the cage.

PARROTS These quaint birds come from tropical lands and so they need special care in our colder climate. They must be kept in a warm room in winter and out of the draughts and direct sunlight. The cage should be of galvanized wire and big enough for the bird to move about. It should be provided with two good perches, the upper thinner than the lower; a ring may be substituted for the upper. The door should slide up and down, closing by its own weight.

Parrots are natural fruit eaters and may be given a mixture of hemp, sunflower seeds, rice, and mashed maize, ripe fruit, preferably bananas, oranges, cherries, and apples, should be given occasionally. Cattle fish bone is acceptable, and rough sand should be scattered on the bottom of the cage. Parrots should not be fed on fish, bread and milk, parsley, chickweed, bones, meat, or anything fatty. Water should be supplied two or three times a day.

Most parrots are great splashers when they bathe, but the grey parrot prefers to roll in the dust. A piece of soft wood for the parrot to tear to pieces should be kept constantly in the cage. This will help to keep the bird busy.

We should always show the parrot gentleness and affection, and never laugh at it when trying to break it of a bad habit. In teaching it to talk, a lesson should be given in the morning and again in the evening, the teacher standing close to the cage and repeating the words clearly.

The little hudgegrig, a relation of the parrot, is now bred by many bird-fanciers. Its diet and care should be similar to that for the parrot.

How to Look After Your Pigeons

PIGEONS There are about 150 breeds of pigeons, including the fancy varieties. Each has a charm and beauty of its own. The first essential in a pigeon-house is that it be mouse and rat proof. This is often accomplished by interlarding or covering the walls with wire netting. The pigeon house should face south, have a rain-proof roof, and be well ventilated. A nesting shelf should be a foot wide, partitioned into spaces a foot in length. The holes for exit and entrance to the house should be provided with a 6 inch alighting board just below, both outside and inside. The house should be kept clean and should be whitewashed with lime, both inside and out. It is best for pigeons to fly freely, if this is impossible, a "fly" of wire netting must be provided.

Their usual food is wheat, maize, and green stuff, hemp or rape seed is given as a treat. Do not give them barley or rice. The grain should not be new, and should be thoroughly dry. Large kernelled maize is likely to choke the birds. If they are fed only twice a day, the food should be placed in hoppers. Tender green food, such as lettuce or onion-tops, may be given at any time. Pigeons need plenty of gravel, or crushed oyster shells mixed with coarse sand and some charcoal. They must have access to plenty of clean water both for drinking and bathing.

TORTOISES Many boys keep little land tortoises, but some of them, we fear, have little idea of the needs of these creatures. A land tortoise should have plenty of liberty. They are vegetarians, and particularly like all sorts of milky plants like dandelions, sow thistles,

lettuce, etc. Never let him into a hutch or tortoise from some hawk who tells you they eat slugs and insects—they don't! They should be given their liberty in the garden in the autumn, as they bury themselves in the earth and hibernate all the winter. Always be sure to supply a tortoise with plenty of fresh water in a shallow bowl. (See also Aquarium, Goldfish)

Phaethon. (Pron fá'-eth-on) This daring and beautiful youth, whose name means "the shining one," was the son of Helios, the sun-god of the Greeks (sometimes identified with Apollo), and the nymph Clymene. In a moment of rashness Helios swore by the sacred river Styx that he would grant his son anything he asked. Phaethon asked the one thing that his father would have refused him—to be allowed to drive the chariot of the sun. God though he was, Helios dared not break his solemn promise, so Phaethon's wish was granted. He started boldly on his journey across the heavens, but very soon lost control of the fiery horses of the sun. Rushing headlong from the heated track, they drew the sun so low that the mountain tops were scorched and finally even the trees and the grass and the grain in the fields were burnt. When Zeus saw that the whole earth was about to be destroyed, he seized one of his thunderbolts and hurled it at Phaethon, who fell like a shooting star into the Eridanus, here identified with the Po. His sisters, the Helades, who stood on the bank weeping, were turned into poplar trees, and their tears, it is said, fell into the stream and became amber.

Pheasant. (Pron fez'-ant) The pheasant is a large game bird with brilliantly coloured feathers, related to the partridge. The males have long showy tail coverts. Pheasants are found in great abundance in England, where they are supposed to have been introduced by the Romans, but so many different types have been introduced for sport that there is no pure species left in Britain. The common pheasant (*Phasianus colchicus*) is about 3 feet long, including the tail, which represents half the length of the bird. The plumage is beautifully mottled brown and buff, with changeable lights of blue and green over the breasts of the males. The male of some types has a red "wattle" over the eye and a white collar round the neck.

Great numbers of these birds are reared and fed artificially, and liberated in game preserves on English estates, the numbers so reared vastly exceeding those that are bred wild. Eggs are collected from birds that are either running wild or kept in pens, and are placed under domestic hens, who make good foster-mothers for the young pheasants.

Some of the wild pheasants of China and India have plumage as gorgeous as that of

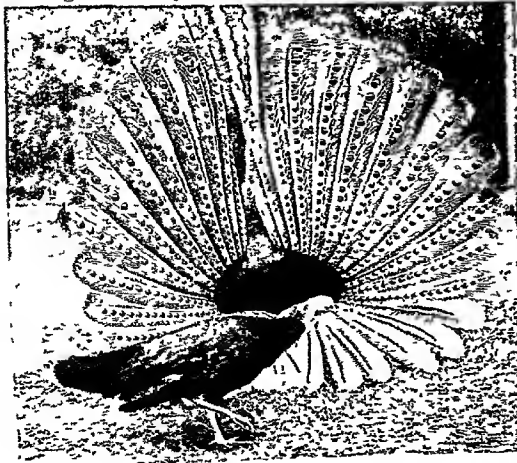


THREE FINE PHEASANTS

Even our own British pheasant (top) is a handsome bird, his brown plumage being set off by a white ring on the neck, and green and red on the head. But he is dull compared with the Himalayan pheasant (right) or the argus pheasant (below), in these species the cock bird is a magnificent fellow, his feathers glistening with iridescent bronze, gold and green.

Photos: top two H. A. Herring; bottom D. Seth Smith.

even the birds of paradise. The golden pheasant has rich scarlet, yellow, blue, and black colourings, a golden crest, and an extremely long tail, beautifully marked. The silver pheasant has upper plumage of silver-white, with black under parts. In England white or nearly white pheasants are sometimes seen, showing a tendency towards becoming albinos.



Pheidias. (Pron H'-d-as) (About 490-432 B.C.) The greatest of all Greek sculptors, and one of the greatest the world has ever known, was the Athenian, Pheidias.

Pheidias, son of Charmides, was born at Athens. He was appointed by Pericles, who had risen to the head of affairs at Athens, to superintend the adorning of that city with fine public buildings, and to execute the most splendid of the statues to be erected for their embellishment.

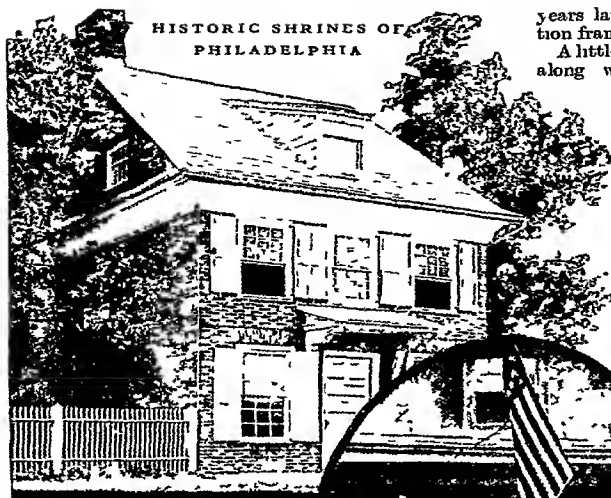


It was largely through the genius of Pheidias that Athens was made the most beautiful city in Greece. He supervised the construction of the Parthenon, the magnificent temple of Athene on the Acropolis, and the giant statue of Athene, in ivory and gold which stood inside the temple, was his own work. (See Acropolis). His colossal gold and ivory statue of Zeus for the Olympian temple in Elis was one of the Seven Wonders of the Ancient World. (See plate facing page 1944).

In his later years Pheidias was accused of appropriating a portion of the gold designed for the robe of Athene. He disproved the charge, but he was then charged with impiety in having placed his own likeness upon the shield of the goddess, and was thrown into prison, where he died.

PHILADELPHIA

HISTORIC SHRINES OF PHILADELPHIA



Above is seen the house of William Penn, founder of Pennsylvania, in the middle is the home of Betsy Ross, who, according to popular belief, made the first American flag

Philadelphia, USA

The statue of William Penn, in his broad-brimmed Quaker hat and full skirted Quaker coat, stands 37 feet tall, enjoying the "fruits of solitude" on City Hall tower, itself 548 feet above the pavements of his "dear Philadelphia," the first capital of the United States of America.

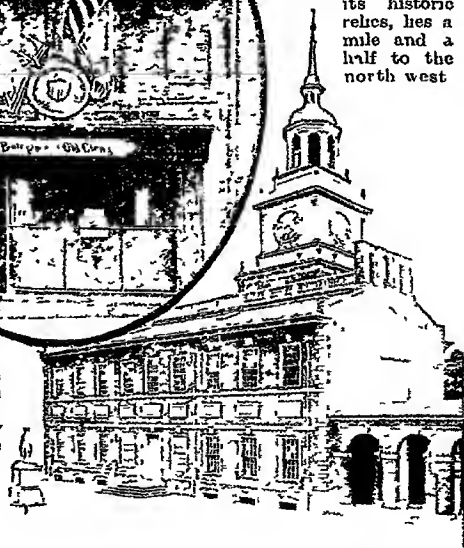
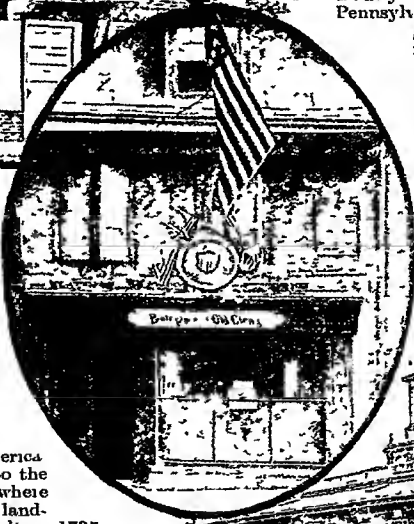
Some distance behind and to the right is Independence Square, where stands America's most famous landmark—the old state house built in 1735, now Independence Hall. Here George Washington was made commander-in-chief of the American armies, and here the Declaration of Independence was signed in 1776, while the old Liberty Bell (now preserved on the main floor of the building) pealed forth "liberty throughout all the land."

Across Chestnut Street stands Congress Hall, where Congress sat from 1790 to 1800, and where Washington, in 1793, and John Adams, four years later, were inaugurated in the Presidency. In Carpenter's Hall, near by, the First Continental Congress met, and there, 15

years later, the Constitutional Convention framed the Federal Constitution.

A little to the north lies Market Street along which, one morning in 1723, munching a loaf of bread while a pretty girl laughed at him from a doorway, trudged a runaway apprentice from Boston named Benjamin Franklin. It is odd that Philadelphia, the most exclusive of cities, really owes most to outsiders, and of these Franklin, founder of the Philadelphia Library, the University of Pennsylvania, and the Pennsylvania Hospital, was certainly the foremost. Today the University of Pennsylvania is one of the greatest universities in the country.

Half way between the City Hall and Guard College you may see the United States Mint. Far mount Park, with its historic relics, lies a mile and a half to the north west.



Immediately above is Independence Hall, in which the Declaration of Independence was signed

PHILADELPHIA

Where the Parkway reaches the entrance to the park stands the magnificent new Art Museum one of the finest in the world. Still farther out, though yet within the city limits, is historic Germantown, with its charming old mansions.

Rittenhouse Square, behind the City Hall and to the left, houses the *élite* of Philadelphia society. Philadelphia, according to the derivation of the name, is the "City of Brotherly Love," but it has humorously been said that it makes all the difference in the world *whose* brother you happen to be—and where you live.

The first element in Philadelphia's greatness was its excellent harbour. Today its situation as Atlantic outlet of the Pennsylvania coal-fields makes it a manufacturing city as well as a great commercial port. Population, 1,950,000.

Philip. Kings of France. The name Philip was first introduced into the royal line of France in the 11th century, by Henry I's queen, who was daughter of a "grand prince" of Kiev and claimed descent from the great king Philip of Macedon. Her son was Philip I of France (1052-1108), the first of six monarchs to bear that name, only three of these are important.

Philip II (1165-1223) is better known by his title "Philip Augustus." He was a contemporary of Richard the Lion-Hearted of England and of Frederick Barbarossa of Germany, and all three went on the Third Crusade to recapture the Holy Sepulchre from the Mahomedans under Saladin. But Philip soon took advantage of a quarrel with Richard to return home. From that time until the end of his reign he devoted his time and energy, with great success, to enlarging his kingdom and increasing his power.

When he came to the throne (1180) the land which he actually ruled was merely a small territory around Paris, while most of the present kingdom of France was held as a fief by the King of England, with whom the French ruler usually carried on continual warfare. From King John, Richard's successor, Philip succeeded in taking a great part of the continental possessions of the English kings, including Normandy, the cradle of their race.

Philip II also strengthened his control over all classes of his subjects, and by encouraging the towns he lessened the influence of the powerful feudal lords. Paris now first became the regular capital of the realm, and the building of the great cathedral of Notre Dame was carried far towards completion.

Philip IV (1268-1314), called "The Fair" because of his good looks, is the next Philip of France who deserves mention. He is the first example of a French king who had both the will and the means to become a powerful monarch, and he set a mark upon French life and government which has not been wiped out

PHILIP

by the floods of successive revolutions. His reign (1285-1314) was notable for the development of the royal power, increase in taxation, the meeting of the first session of the Estates-General (a national assembly corresponding to our English Parliament), and for his successful struggle with Pope Boniface VIII.

Philip VI (1293-1350) is important for the momentous consequences of his accession for both France and England. In 1328 the last Capetian King of France, Charles IV, had died without a son, and there arose the question of succession to the throne. It was decided that a woman could not rule over France, and that she could not hand on her claim to a son. The throne, therefore, went to Philip of Valois, the nearest descendant in the male line, who became (1328) Philip VI of France. His chief rival was Edward III of England, nephew of Charles IV.

At first this decision was accepted by all, but in 1337 Edward III denied the justice of it, and laid claim to the throne of France on the ground that he stood nearer in relationship to the last preceding King than did Philip. This claim was one of the grounds for the Hundred Years' War, which was waged, except for brief intervals, until 1456, and which ended by England losing all her possessions in France except Calais. The war also helped the King of France to consolidate his power into the absolutism which existed until 1789.

Philip. Kings of Spain. The first, third, and fourth of the name left no trace of their personality. Philip V also—this first of the French or Bourbon kings—was "distinguished for few faults and few virtues," but this weak-minded monarch acquires importance from the devastating War of the Spanish Succession (1701-13) by which he gained his throne (See Louis, Kings of France).

Philip II (1527-1598) in 1556 took up the burden of ruling Spain when his father, Charles V, laid it down and he continued to carry it until his death in 1598. His kingdom included Spain, the Netherlands, parts of Italy, and the Spanish possessions in the New World, the other possessions of Charles V going to Charles's brother Ferdinand, head of the Austrian Hapsburgs.

He was 28 years of age when his father abdicated, but he was prudent and experienced beyond his years. Though conscientious and well-meaning, he believed that his mission in life was to win world-wide power for Spain and the Roman Catholic Church. His wife, Queen Mary I of England, died two years after he became King, and he had small chance to win England for Spain after that, with Queen Elizabeth as his rival. He was no match for her in international intrigue, and his effort to conquer England was a failure (See Armada).



PHILIP II RECEIVING A DEPUTATION FROM THE NETHERLANDS

The attempt of Philip of Spain to convert the Netherlands into a Spanish dependency administered by Spanish officials aroused the resentment of many members of the aristocracy of the Netherlands prominent among whom was Lamoral, Count of Egmont. In 1565 the Count went to Spain to discuss the question with Philip, but the king steadily evaded the issue. The illustration above, from a painting by Sant Arcos shows Philip II receiving a deputation of noblemen from the Netherlands.

This defeat alone would not have wrecked Spain, but Philip's policy had weakened the country in other ways. For instance, he had scattered over all Spain the Moriscos (Moslems) of Granada, the thriftiest of his people. His intrigues in France against the Huguenots and on behalf of the Catholic League were frustrated by the victories which brought the Protestant Henry of Navarre (Henry IV) to that throne. And his efforts to stamp out Protestantism in the Netherlands led in 1568 to a revolt under William of Orange, and to the final independence of the Dutch Netherlands or Holland.

Philippine Islands. (Pron fil' i pin) Scattered in haphazard fashion between the China Sea and the Pacific Ocean, the Philippines lie wholly within the tropics and form an archipelago almost as large as that of the British Isles. Luzon is the farthest north of the large islands, and Mindanao is in the extreme south. Between Luzon and Mindanao are eight other islands of considerable importance, while to the south west is the long narrow island of Palawan. Hundreds, however, are so small that they are mere specks in the ocean, inhabited only by sea birds. All but 462 out of the 7,083 islands occupy areas of less than one square mile apiece.

On all the larger islands the scenery is made beautiful by high mountain ranges and by the diversity and abundance of the tropical vegetation. More than half of the entire surface is covered with forests, many of which, in the mountainous interiors, are inhabited by savages and have never been fully explored.

There are about 50 volcanoes scattered about the archipelago, some of which are still active. Summer and winter are very much alike in the Philippines, the surrounding ocean makes the climate equable. During the rainy season the much dreaded typhoon or "baguio" does its deadly work. Hour after hour the rain descends in sheets, overturning small houses and sending insecure roofs and shutters sailing away.

Probably in no other part of the world are there so many distinct peoples on a small area as in the Philippines. The original inhabitants were pygmy blacks, the Negritos or "Little Negroes," one of the most diminutive peoples in the world. Like the African negro, they have crisp hair and wide noses, but they rarely attain a stature of five feet, and seldom live to be 50 years old. For the most part the 30,000 Negritos are still true savages, building no houses, and depending chiefly on the game they kill with their bows and arrows. Being a timid people, these tiny black men keep to the

Extent—Area 114,400 square miles of which about two-thirds are contained in Luzon and Mindanao. Population estimated at 13,000,000.

Physical Features—About 7,083 islands, largely of volcanic formation, traversed from north to south by irregular mountain chains. Highest peak, Apo Volcano (on Mindanao), 9,610 feet. Moist tropical climate with frequent hurricanes and earthquakes.

Principal Products—Rice, Manila hemp, sugarcane, coconuts and copra, tobacco, coffee, manufactures of cigars and cigarettes and coconut oil, lumber, fish, cattle, some gold and other minerals.

Chief Cities—Manila (capital) about 361,600. Baguio (summer capital), Cebu (82,000), Iloilo (45,000).

PHILIPPINE ISLANDS



HOMES AND HABITS OF THE FILIPINOS

If you were a Filipino on the island of Cebu, you would live in a house like the one on the left. The upper storey projects over the lower, and the outer walls are mostly sliding frames. The native in the centre is carrying a load of hemp on his head. This is a common form of transport. On the right is one of the public markets of the islands, where the people gather from the surrounding countryside to buy and sell live-stock and farm products.

depths of the forests, where they were driven by the Malays, and give little trouble.

The Igorots and allied tribes are a much more numerous savage people, who keep to the mountains as persistently as the Negritos to the forests. They are strong and enterprising, of medium stature, with mixed Chinese and Malay blood.

The most formidable people with whom the Spaniards and Americans had to deal when colonizing were the Moros, a Malayan race. They still number about 400,000. Though driven out of the northern islands by the Spaniards, they still hold practically all of the large and fertile island of Mindanao, and the Sulu (or Jolo) Islands south-west of it.

The seven great tribes in the Philippines who have adopted the Christian religion are known as the Filipinos. From the intermarriage of these Filipinos with Spaniards has sprung another type, called *mestizos*, a numerous and powerful class whose influence is strongly felt in political and industrial affairs. The early Filipino type has also been profoundly modified by Chinese blood. Though the Chinese constitute only one per

cent of the total population, they control three-fourths of the retail trade and commerce.

The Filipinos had a written language when the Spanish found them, and other elements of civilization. The Spaniards converted the Filipinos to Christianity, but there they stopped. In the three centuries of their occupation they did practically nothing in the way of public improvements, nor did they bestir themselves for the advancement of education.

The soil of the Philippines is very fertile, producing astonishingly heavy crops year after year. The principal crop is the so-called Manila hemp, which is not hemp but the fibre of a wild plantain.

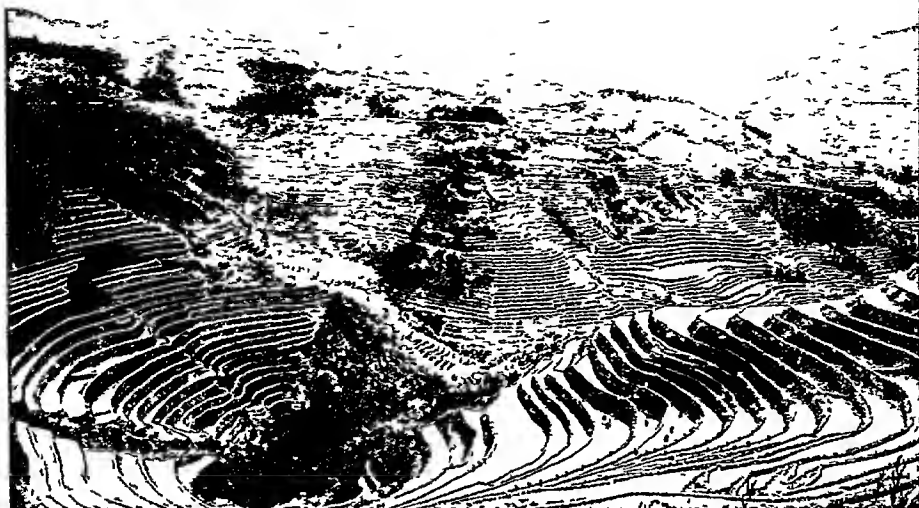
Sugar is the most valuable of the crops grown for export. Tobacco is another characteristic product, in quality among the best in the world. The home consumption of tobacco is very large, yet more than 300,000,000 cigars are exported annually. More copra (the dried meat of the coconut) is produced than in any other country. The principal foods of the Filipinos are rice and fish.

The Philippines were discovered in 1521 by Ferdinand Magellan, the Portuguese who also



MRS IGOROT IN HER RICE FIELD

Rice is the staple food of nearly all the Philippine Islanders. It is grown in water-covered fields. This woman is typical of the Igorot people.



THE TERRACED RICE LANDS OF THE PHILIPPINE MOUNTAINS

At first glance, you might think this the ruins of some gigantic amphitheatre but in reality it is a striking view of the terraced rice lands in the mountainous regions of the Philippines. These protecting walls are built, one above another, to retain the water and hold the precious soil in place so that it will not be washed away by the tropical rains.

discovered the strait at the southern extremity of South America which bears his name. In 1542 Ruy Lopez de Villabos attempted to conquer the islands, and named them "Filipinas" in honour of Prince Philip of Spain. They remained Spanish until after the war of 1898, when they passed to the U.S.A. In 1934 the islands were granted independence after a ten-year preparatory period. A new constitution was drawn up, and in 1935 the first President of the Philippines took office.

Philistines. When the Israelites entered the Promised Land, among the tribes which they found there were the Philistines, who proved to be their greatest enemies. They were the strongest of the Canaanite tribes, and acquired so much power and influence that the whole country became known as Palestine, or the land of the Philistines.

Their group of five cities—Gaza, Ashkelon (Ascalon), Ashdod, Gath, and Ekron—formed a small district on the coast of the Mediterranean south-west of Israel. It is thought that they



PHILISTINES TAKEN PRISONER

Rameses III of Egypt defeated the Philistines and other Peoples of the Sea, and his victory was commemorated in the above panel from an Egyptian memorial. It shows a party of captive Philistines, some with their wrists bound. The Biblical giant Goliath, was a Philistine. Though they are mentioned many times in the Old Testament, the history of the Philistines is still largely hidden from us.

By courtesy of Sir Flinders Petrie

were of the Mediterranean race and came originally from Crete. Like the Semitic Phoenicians, to the north of Israel, they were a seafaring people, but while the Phoenicians confined themselves to peaceful pursuits, the Philistines continually harassed the Israelites and sought by conquest to extend their territory to the east.

They finally fell before the great conquerors who, one after another, swept Palestine.

The name "Philistine" was applied by German students to shopkeepers and other non-university folk, and—largely through the influence of Matthew Arnold—it has now come to mean an uncultured, narrow-minded person.

Philology. (Pron fil-ol'-o-ji) The word "philology" comes from the Greek *philein*, "to love," and *logos*, "word, speech." Philologists, or students of language, have discovered many interesting and unexpected things by comparing languages. By tracing the words from one tongue to another, and back to their original meanings, they have found, for instance, that many languages which at first seem to have nothing to do with one another are really related. And they have been able to puzzle out a good many facts about the original language from which many of the modern languages have developed.

Language grows much as a tree grows—the big simple things first, like the roots of the tree, then more complicated things that reach up like the trunk and the branches, and, next, the thousands on thousands of little separate words, each like the others and yet different, like the leaves.

Language is still growing, growing and changing all the time, though you may not notice it. New words are being added and old words dying, and some words are changing their meaning on our very tongues. Probably the main outline of a language will not change so much as it did in former times, because of printing and the general spread of knowledge. But smaller changes will always take place.

Words that Die and Are Born Anew
Take, for instance, an old English word "frampold," which was a good word in Shakespeare's time, and meant "peevish." It grew old like a yellow leaf, and fell away. Few people today would have any idea what you meant if you spoke of "a frampold woman." On the other hand, Shakespeare would not have the slightest idea what you were talking about if you could speak to him about a "telephone." But one of the most curious things is the way a word will sometimes remain in the language but change its meaning. The word "imp," for instance, once meant "offspring" or "scion," and there is a dignified old epitaph still in existence which begins, "Here lies that noble imp." How ridiculous that sounds today! Or

take the word "host," which comes from the Latin *hostis*, meaning "enemy." It has been so altered in meaning that now it means any army or large body of people, your own quite as much as your enemy's.

Probably the most interesting discoveries have been in connexion with the Indo-European group of languages. These languages are also called Aryan, and the people who spoke them were once all classed as Aryans, but nowadays the term Aryan as a race name is confined to the eastern branch of the Indo-European peoples.

The scientists first made these discoveries by finding that Sanskrit, a dead language of India, was really a sister tongue to Greek and Latin and to the Teutonic sub-group of languages to which English belongs. With this as a key they were able to group almost all the languages of Europe and some of those of Asia into a system, and to make a good guess as to their origin. What they now think is that the original Indo-European root language grew up in the grasslands surrounding the Caspian Sea.

How the 'Mother' Language Spread

In course of time people began to migrate, some going east and some west. As they got separated farther and farther from one another, and as the years passed, differences began to appear in their languages. At first if they met accidentally they could undoubtedly still understand one another. But after a few centuries these different groups grew so far apart in language that they could not understand one another at all, just as you cannot understand German without studying it, though English and German are really closely related.

But certain words, or rather the "roots" of certain words, are found in all these languages, so we can be sure these words existed in the mother language. For instance, our English word "mother" is *Mutter* in German, *mater* in Latin, *meter* in Greek, *matar* in old Persian, *macar* in Tokhar (Central Asia), and *mata* in Sanskrit. By examining carefully which words are found thus in all the group languages the philologists have been able to find out certain things about the people who made the language in the first place. They seem to have been an agricultural people, with domesticated animals, and a definite form of government, and to have been in some ways quite highly developed.

The study of comparative philology began in the last part of the 18th century. Sir William Jones in England had perhaps the first real idea of its scope, but two Germans, Franz Bopp and Jakob Grimm—of fairy tale fame—did the first thoroughly scientific groundwork. Max Müller, another German who taught at Oxford, also wrote many books on the subject. And today there are a host of philologists studying the subject, and every language and dialect, even

PHILOLOGY

the most unimportant, is being carefully studied. If you take any good unabridged dictionary you will find the "etymology," or history of the word, usually given in parentheses after the word itself. These histories are often very interesting, and they give the word a depth of meaning which you might never suspect otherwise.

The Indo-European group of languages mentioned above is divided into a number of smaller groups, of which the principal are the *Hellenic*, which includes all the old Greek dialects, the *Italic*, which includes Latin and all the modern languages that come from Latin and are usually called Romance languages (Italian, French, Spanish, Portuguese, etc.), the *Celtic*, including Welsh, Gaelic, etc., the *Teutonic*, including German, Norwegian, Swedish, Dutch, English, etc., the *Slavonic* including Russian, Polish, Serbian, etc., the *Indic*, which includes Sanskrit and ancient Indian dialects, as well as the various modern dialects derived from these, like Hindustani, the *Iranic*, comprising Persian and some allied tongues, and the *Anatolic*, including Armenian, Phrygian, etc.

These Indo-European languages all belong to what is called the "inflected" languages, that is, they have a more or less complicated system of grammatical changes to indicate case, number, person, tense, and the like. There are, however,

PHILOSOPHY

two other types of language. One type is inflected to a smaller degree than the Indo-European tongues, but still has the addition of prefixes, suffixes, and infixes to the root word. These are called "agglutinative" languages. To this class belong Turkish, Mongolian, many American Indian languages, etc. The third class is called monosyllabic or "isolating," because in these languages each root-word, which represents a root idea, is a monosyllable. Chinese is the principal language of this group.

The languages which do not belong to the Indo-European group are divided into a dozen or so other groups, of which the most important are the *Semitic* family, which includes Hebrew, Phoenician, Arabic, Abyssinian, Syrian, etc., the *Bantu* family, a primitive group spoken in South Africa, the *Malay-Polynesian*, or monosyllabic family, of which Chinese and Tibetan are the principal examples, and the *Ural-Altaic*, including Turkish dialects and Hungarian.

Next to the Chinese, which is spoken in its various dialects by nearly 400,000,000 people, the English language is the most widely distributed, being spoken by about 160,000,000. It is said that German is spoken by about 110,000,000, Hindustani, 100,000,000, Russian, 100,000,000, French, 70,000,000, Japanese, 55,000,000, Spanish, 50,000,000, Italian, 50,000,000.

TRYING to UNDERSTAND the UNIVERSE

There is an old gibe about a philosopher being like a blind man in a dark room looking for a black cat that isn't there. Actually, however, he studies Philosophy in order to see things as they really are, and see them whole.

Philosophy. "It was owing to wonder," said Aristotle, "that men first began to philosophize—wondering at first about the



Plato
The Vatican & the Alinari

problems that lie close at hand, and then little by little advancing to the greater perplexities." In this sense we are all occasionally philosophers. We philosophize when we reflect intensely upon what we are actually doing in the world, the meaning of life, right and wrong or how there came to be a world at all. The word "philosophy" comes from the Greek *philos*, meaning "to love," and *sophia*, meaning "wisdom." Hence philosopher originally meant a lover of wisdom, and though philosophy has since come to mean many things to many men, it still, as one living philosopher has

put it, is thinking about *thinking*, and in that sense it practically covers everything, including the things you think of or experience. Philosophy is clearly very close to psychology (*g v*), which, however, is chiefly concerned with the processes or machinery of the mind, memory, sensation, feeling, and so on, as affecting human behaviour, not the finished thought, or the thing thought of. There is no objection to saying that philosophy consists in trying to see all time and existence as a whole—but that, of course, is a very general definition.

Today a study of the world and science and society is broken up into many divisions. But at first there were no such separate departments of study, and the early philosophers studied subjects which today would be called astronomy, physics, or natural history, as well as logic, ethics, and metaphysics, which may be comprised under philosophy. When we detach one particular aspect of the world or of society and study that by itself, we usually call this a science, especially if we study something which we can count or measure exactly. But, on the other hand, if we aim at more than a precise



GREEK THINKERS WHO LAID THE FOUNDATION OF THE WORLD'S PHILOSOPHY

This magnificent fresco by Raphael depicts the leading Greek philosophers. In the centre Plato, with Aristotle on his left, is expounding his ideas to his disciples. On the steps lies Diogenes, the Cynic, and in the upper left-hand corner Alcibiades and Xenophon, the great soldiers, and others are listening to Socrates. Below them are Pythagoras, Heraclitus, and Democritus, the atomist. On the right, on the steps, are Pyrrho, Arcesilaus, and others, while in front Archimedes is teaching geometry to a group of his pupils.

For Raphael's gallery the Vatican photo library

statement of one particular part and try to find the meaning of the whole, we call it philosophy.

In one very wide sense philosophy can be said to mean *metaphysics*—the discussion of various abstract questions connected with the nature or structure of the universe and its fundamental laws, which the sciences and life suggest but do not solve. The sciences use such words as space, time, matter, and causality, without examining the meanings of the words, metaphysics asks such questions as: What are space and time? What is meant by a "thing," and how does it differ from an "idea"? How are mind and body related? Do they act on each other? Metaphysics inquires into the cause, the substance, and the outcome of all things.

Morality—Reason or Intuition?

When we are judging right and wrong (which is the province of the branch of philosophy we call *ethics*) some consider that we can decide by reason, others believe that right and wrong are rather matters of feeling or emotion arising from the drive of those inborn tendencies of our nature we call instincts. When we ask what standard we shall actually use, some have held that the most important thing is whether our conduct produces happiness or self-fulfilment, and others whether it enlarges our life by making us more perfect towards some imagined pattern of perfectibility.

The first school are called *hedonists*, from the Greek word that means pleasure or happiness, the other school have been called by various names, but most frequently *ethical idealists*. Hedonists are further subdivided according as they emphasize the happiness of the person himself or the happiness of others as the true test. The first are called *egoists*, or sometimes *epicureans*, because the Greek philosopher Epicurus was the founder of a school which held this doctrine, the second group are sometimes called *altruists*. One particular group of altruists, mostly active in Great Britain in the early part of the 19th century, was called *Utilitarians* or *Benthamites* after Jeremy Bentham (q.v.). Their maxim was "the greatest happiness of the greatest number."

Induction and Deduction

We have to see or hear or touch, and we have to arrange or organize in our minds our ideas about what we see and hear and touch. We raise such questions as "What are things made of?" and "What is the cause of this or that?" Now, some philosophers have emphasized the first of these questions and have thought that the particular things that we see and hear and touch are the more important. They then endeavour to form some general principles from examining these particular facts. This method is called *induction*, and the

philosophers who use it are called *empiricists*, since they rely on the evidence of experience.

On the other hand, some philosophers have been most impressed by the fact that, if we can find a general law, such as that of gravitation, or set up some general standard of right and justice, we can then proceed to understand or judge particular facts by bringing them under this general law. If a book falls from the table, we explain it by saying that it is due to the law of gravitation. To begin with a general law or rule and proceed to particular cases is called *deduction*, and the philosophers who have tried to understand the universe by first grasping its general nature are called *rationalists*. They believe that by pure reason it is possible to make many statements about what must happen or what men ought to do.

As a matter of fact, induction and deduction are only different aspects of the same process of experience. You cannot say that certain events will happen because they are deducible from some general law until you have built up the general law (that is, by induction) from events of the kind in question. From this standpoint, induction is primary, and unless general laws are constantly re-defined or modified by experience, as in science, deduction is apt to become a very dangerous tool. The highly imaginative deductions of many cloistered philosophers of the past accounts for much of the metaphysical nonsense that has unfortunately been printed. In recent years philosophy has been vitalized by the strong inductive and logical bent of modern thinkers.

The Test of Practicality

Another school, called *pragmatism*, has still another method of approach. Every idea, says William James, may be tested by the question, "What sensible difference to anybody will its truth make? If you claim that any idea is true, assign at the same time some difference that its being true will make in some possible person's history, and we shall know not only just what you are really claiming, but also how important an issue it is, and how to go to work to verify the claim." This method neglects the content of an idea and follows its use only, under the theory that the use is the real test of its truth and meaning. The idea is true and its truth demonstrated if it works.

When you study the world it is very evident that there is a sense in which there are a great many separate things, such as rocks and trees and persons, there is also a sense in which we say that our body is one thing and our mind is another. But, on the other hand, it seems equally clear that all these separate things are in some sense related to one another—that is, are not entirely separate but, as it were, one. A man's mind and body together make up one

person, and every part of the universe is probably affected by every other part. Those philosophers who have emphasized the unity of the world are called *monists*, and those to whom the distinctions and separateness between things seem most important are known as *pluralists*.

Perhaps the simplest distinction in our world is that between persons and things. Persons are alive and think and move of their own will, things do not move unless they are acted upon by some other thing or by a person. Some philosophers have thought of the world as though it were all made up of things, or, to use the technical term, of matter. They have been called *materialists*. Others have believed that the world is to be regarded rather as though it were to be understood as mind, and they have been called *idealists*.

Besides metaphysics and ethos, there are two other important divisions of philosophy: *logic*, which is the science of thinking and of classifying arguments into good and bad, and *aesthetics*, the science of the beautiful, in its broad sense—including the sublime, comic, and tragic.

The first people to think systematically about the great questions of the universe and give philosophy a meaning were the ancient Greeks, represented by such famous names as Thales, Heraclitus, Democritus, Aristippus, Socrates, Plato, Aristotle, Pythagoras, Epicurus, Zeno, Epictetus, and Diogenes.

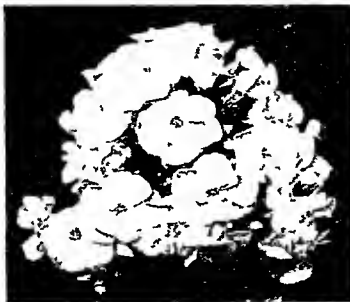
After three centuries of intellectual darkness a new school of thinkers arose, who attempted to harmonize the doctrines of Aristotle with the teachings of the Church. This system, known as Scholasticism, was the creation of such famous medieval philosophers as Duns Scotus, Thomas Aquinas, Peter Lombard, Abélard, and Anselm. The stimulating influence of the Revival of Learning led men into fresh paths of philosophical thinking. Francis Bacon founded modern empiricism, and the Frenchman Descartes established modern rationalism.

During the last three centuries important contributions to philosophic progress have been made in the leading countries. The outstanding names in Great Britain are Thomas Hobbes, John Locke, George Berkeley, David Hume, Dugald Stewart, Jeremy Bentham, John Stuart Mill, Herbert Spencer, T. H. Green, F. C. S. Schiller, G. E. Moore, Bertrand Russell, Alfred N. Whitehead, and Samuel Alexander. Germany

produced such distinguished thinkers as Leibnitz, Kant, Fichte, Hegel, Schelling, Haecel, Schopenhauer, Nietzsche, Hartmann, Lotze, Herbart, and Wundt. France is represented by Malebranche, Descartes, Condillac, Diderot, Rousseau, Voltaire, Comte, Cousin, and Henri Bergson. Holland produced the great Spinoza. The United States is chiefly known by the work of Josiah Royce, William James, George Trumbull Ladd, and John Dewey. Italy has produced Benedetto Croce.

There are separate articles on the most important of the above.

Phlox. These hardy garden flowers yield a wealth of bright coloured clustered blossoms throughout the summer and early autumn.



FLOWERS OF THE PHLOX
The full beauty of the herbaceous perennial phlox is seen to advantage in July and August, and these plants are just the thing for the shady parts of the garden, for they flourish well in cool spots.

Perhaps the best-known of these is the moss pink (*Phlox subulata*). It grows only about six inches high and has prostrate stems and dense masses of blossoms that completely hide the thick mats of moss-like foliage. In early May it makes a brilliant carpet in our gardens.

Phoenicians. (Pion fē nēsh'anz) More than 2,000 years before the days of Columbus, keen-eyed, dark-skinned mariners anchored their well-laden ships from Phoenicia off many a shore of this blue Mediterranean and even beyond in the unknown seas. The people came flocking down to purchase their wares, for the Phoenicians were the great merchants of ancient times. Through their hands passed the rich treasures of every known land—perfumes and spices from the Far East, fine linen from Egypt, wool from Arabia, woven into robes of pure white or rich purple, vessels of brass, silver, and gold, wrought by their own skilled artisans, ornaments of carved ivory, emeralds, coral, agate, and amber, and other stores yielded by bountiful Nature or devised by Man.

PHOENICIANS

These Phoenicians (the Canaanites or Sidonians of the Bible) belonged to the Semitic race. Their country was a narrow strip of the Syrian coast about 200 miles long and about 20 miles wide. It was a land of meadows and pastures, of orchards and vineyards, but so scanty that the Phoenicians were fairly pushed off to sea for a living. Surpassing their teachers, the Egyptians, they became the most skilful shipbuilders and navigators of their time.

They passed through the Straits of Gibraltar, worked the silver mines of Spain, founded the city of Cadiz on the western coast, sailed as far as the British Isles in quest of tin (see page 1521), and even sailed round the southern point of Africa. They founded many colonies, the greatest being Carthage, which in turn established colonies of its own and grew into a great empire and rival of Rome (See Carthage).

The Phoenicians acquired the arts and industries of many lands and passed them on to the rest of the world. They developed the art of glass-making, which they learned from the Egyptians. They knew how to mine and work metals. They wove cloth of fine texture and beautiful design. From a little shellfish called *murex* they obtained a dye of beautiful purple (or more properly crimson). But the most precious gift they gave the western world was the alphabet. They early found the clumsy clay tablets of Babylonia inconvenient for keeping their accounts, and so they imported papyrus paper from Egypt, and devised an improved alphabetic system of 22 signs for writing their language.

The Greeks, with whom they traded much, were quick to see the advantage of the Phoenician alphabet, and soon began using it to write their own language. Thus it is from the Phoenicians, through the Greeks and Romans, that we derive our own simple and practical alphabet (See Alphabet).

There were two great cities of Phoenicia—Sidon,

the centre of the glass industry, and Tyre, the centre of the purple dye industry. In the middle of the 10th century B.C. Tyre assumed the leadership of all Phoenicia. Friendly relations were established with the Hebrews, and King Solomon sent to King Hiram of Tyre not only for materials but for skilled workmen to build the temple.

In the 6th century the Phoenicians supplied the great fleets with which Darius and Xerxes attacked Greece. For the most part they submitted readily to their foreign masters and were allowed to retain a certain degree of



PHOENICIAN MARINERS OF THE ANCIENT WORLD

Evidence about the origin of the Phoenicians is extremely scanty, but we do know that they were the earliest agents in the spreading of trade and arts. Skilful mariners, they sailed far and wide from Syria, founding many colonies, the greatest of which was Carthage. They even reached Britain, taking back tin from Cornwall.

PHOENICIANS

independence Alexander the Great, in 333 B. C., took Tyre after one of the greatest sieges of history. In 64 B. C. Phoenicia came under the control of the Romans, and the native language and institutions became extinct.

The Phoenician religion was a form of Nature worship; the chief divinities were the god Baal and the goddess Astarte, or Ashtoreth. In times of great distress human sacrifices were offered to the god Moloch. Many of the religious practices were barbarous and degrading.

Today the small island on which the 25,000 inhabitants of Tyre once crowded into lofty many-storeyed houses is connected with the mainland by a broad tongue of land, which has grown out of the mole built during Alexander's siege, and the site is occupied by an unimportant town (Sur) of 5,000 inhabitants. Fruit gardens cover the place where Sidon once stood, furnishing the main support of the 15,000 inhabitants of the modern city of Said.

Phosphorescence (Phos for-ces'-ents) AND **LUMINESCENCE** Many minerals, especially the sulphides of calcium, strontium, and barium, shine in the dark because they have been previously exposed to light. Living creatures also generate light, but in a way that

PHOTO-ELECTRIC

Luciferase These are manufactured by the cells of the animal. In the presence of air and water, luciferin unites with oxygen and produces light, while luciferase is a sort of enzyme or ferment which starts the process and keeps it going. In some cuttle-fishes the light appears to be produced by bacteria. (See illustrations in pages 503 and 1632.)

The so-called phosphorescence of the sea is due to protozoa. There are many luminous forms of life. Luminous bacteria cause decaying flesh to emit light.

Phosphorus. Perhaps the most common use of phosphorus is in making matches. (See Matches.) At temperatures below 95° F. ordinary phosphorus is an almost colourless or faintly yellow solid substance, having the glistening appearance and consistency of wax. Perhaps its most striking characteristic is that it glows in the dark with a greenish-white light, due to its slow combustion or oxidation.

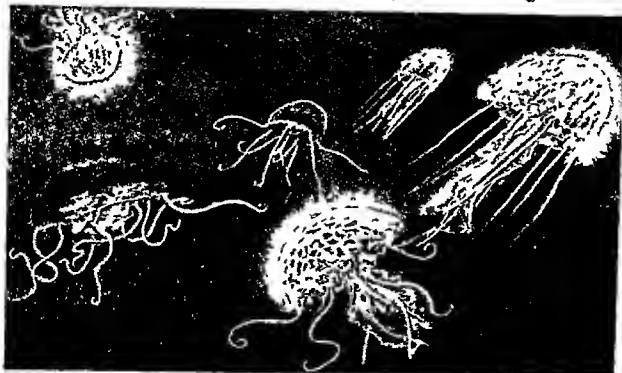
Phosphorus, taken internally, is a very powerful irritant poison. Persons regularly engaged in the manufacture of matches were often seriously affected by it. Decay of the jaw bone (called "phossy jaw") was of common occurrence among such workers. This danger has been over-

come to some extent by the use of red phosphorus, one of the "allotropic modifications" of the pure element, with very different physical properties from those of the ordinary form—for instance, this phosphorus is quite non-poisonous, and comparatively inert.

Phosphorus was discovered in 1669. It occurs in combination in the mineral apatite and other rocks, in guano, and in bones, muscles, nerves, brain, and other body substances, for, poisonous though the element is, its compounds are necessary to life and are an essential constituent of all fertile soils. (See Fertilizers.) Egg-yolks and beans contain large quantities of phosphorus.

Commercial phosphorus is obtained from bones and from the "phosphate rocks" formed from fossil bones.

Photo-electric Cells. Photo-electricity or the conversion of light energy into electrical energy was accidentally discovered in 1873 by a Mr. May, some 56 years after the discovery of selenium by Berzelius. May noticed that the electrical resistance of certain selenium apparatus varied as the light



'PHOSPHORESCENT' JELLY-FISH

Many jelly-fish are luminescent, and in the Mediterranean it is often possible at night to watch mysterious companies of these creatures rising, with an increasing glow, from the outer darkness of the sea. Here are shown some lighted and some unlighted.

American Museum of Natural History

is quite different. Phosphorescence, in its strict sense, applies only to the property of continuing to shine in the dark, without sensible heat, after exposure to light or other forms of radiation.

The light of living organisms is more properly called luminescence or bio-luminescence. It is not produced by phosphorus, which is a very poisonous element. In the lantern of the firefly there are two substances, *luciferin* and

which fell upon them changed. In 1888 W. Hallwachs confirmed a discovery by Hertz (*qv*) that is the basis of the photo electric cell, namely that a negatively charged zinc plate loses its charge when illuminated by ultra-violet rays.

Recently other metals—sodium, potassium, caesium, etc.—have been found to emit electrons when exposed to light. The photo electric cell consists of a plate covered with one of these metals, enclosed in an evacuated or gas filled glass bulb and connected to the negative terminal of a battery. A wire (rod, near this plate, is connected to the other terminal, and when light falls on the sensitive surface a current flows in the circuit proportional to the light intensity. This can be amplified and used for many purposes.

By means of a one valve amplifier similar to a wireless set, a cell can be made to operate a switch controlling electrical machinery, such as a counting mechanism, an electric bell, etc.

Moving objects may be counted by the interruption of a beam shining across their path into a cell, mechanisms can be actuated to throw off a conveyer unlabelled or defective articles, owing to the different light reflected from them compared with the perfect ones.

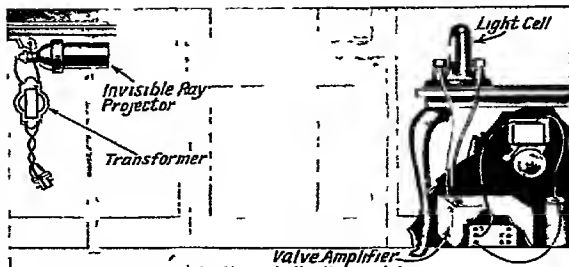


PHOTO-ELECTRIC CELL BURGLAR ALARM

This diagram shows clearly the main connections necessary for the invisible ray burglar alarm. To enter the room, the burglar must first of all pass through the ray. In so doing he closes an electric circuit, causing an alarm bell to ring and, perhaps, lights to be switched on.

Courtesy of Radiovisor Patent Ltd

It may be timed accurately, an intruder rings a burglar alarm by interrupting an invisible ray of infra red light. Street lamps can be lit at dusk and turned off at dawn automatically, apparatus of this type gives warning at the entrances of the Mersey Tunnel if a vehicle that is too high attempts to enter.

Another group of photo electric devices measures the current variations with a sensitive galvanometer. Colours of liquids, textiles, etc., can thus be graded and standardized more finely than by the human eye.

SCIENCE and ART of USING a CAMERA

The camera has made everyone his own artist, and this article explains not only how the miracle of photography takes place, but at a how the most pleasing and effective pictures can be taken by everyone.

Photography. Almost everyone nowa-days possesses a camera, or has used one, and has a rough idea of how it works. But it may be worth while to consider what actually happens when you take a photograph.



When you "press the button," or release the shutter, you allow a beam of light to enter the camera. This light strikes the surface of the film or plate at the back of the camera. This film is coated with a silver salt, usually silver bromide, which is sensitive to light. A white article reflects more light than a dark article, so that the parts of the plate or film which have caught the impression of white articles will have received

more light than those which have caught the impression of dark articles. Films in roll form or as flat sheets are nowadays used much more extensively than glass plates.

The light produces a chemical change in the silver salt on the photographic film or plate, but this change is not visible to the eye. When, however, the film or plate is "developed" by chemicals the change becomes visible, and the image is clearly seen. It is then "fixed" to prevent the light from having any further action upon it.

The image that can now be seen shows everything reversed: white objects are shown black, and dark objects are shown white. In order to produce the finished photograph a piece of paper, with a sensitive coating of a silver salt, is placed behind the plate in a special frame, and is exposed to artificial light or to the sun. The dark parts of the plate or film prevent light from penetrating, whereas the lighter parts allow it to get through and affect the sensitive surface.

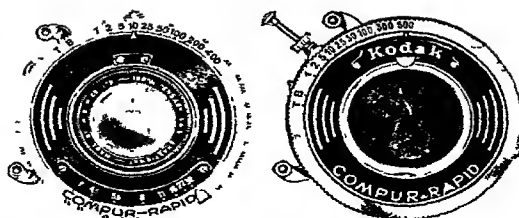
of the paper. The paper is then "developed," and "fixed" in much the same way as the plate or film was, and thus we have the completed print with the correct light and shade—a faithful reproduction—if we have been careful and accurate—of the object photographed.

This is a very brief account of what happens in taking and making a photograph. We may now consider the apparatus and the different processes of photography in greater detail.

First of all, the camera itself. The simplest kind in general use is the box camera, in which you merely insert the film and press down the shutter release to take a photograph. It must always be borne in mind that good photographs can be taken with even the cheapest and simplest kinds of camera, and that, while dearer, more elaborate cameras have certain advantages, they also require more expert handling, and offer more chances of making mistakes.

In the simplest box cameras the distance between the film and the lens, the aperture of the lens, and the time of exposure are fixed, but in more elaborate makes (pocket folding cameras, reflex cameras, and so on) these are variable. Thus, in a folding camera, you will see that you can pull out or extend the front. There is usually a scale to show you how far it is to be brought out, according to the distance from the camera of the article to be photographed. Thus, if you bring out the front to the point marked 6 ft., an object six feet from the camera will be "in focus"—that is, will give a sharply defined image on the sensitive film or plate.

Then, again, at the front of the folding camera you will see various figures. Those marked $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{10}$ (or in some such series) refer to the length of the exposure, in terms of



MODERN LENS AND SHUTTER

On the mount of the lens of your camera are two sets of figures. One set at the top of both lens mounts illustrated, gives the time of exposure, either long exposures (T and B) or shorter ones, 1 sec to 1/1000th or 1/500th part of a sec. The set at the bottom (left) shows the lens opening or aperture. The lens on the right has had its front glass taken out to show the shutter with its five leaves.

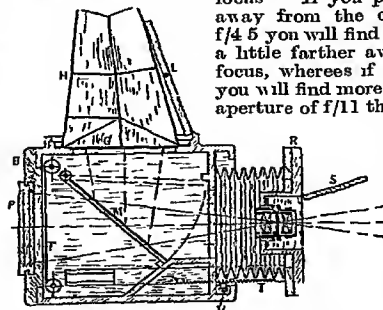
Kodak Ltd

When the pointer is at B the shutter opens when you push down the release and closes when you take away the pressure from the release. These two, T and B, are only to be used for making long exposures.

Above or below the lens you will find another set of figures in some such order as this—f/4.5, f/6.3, f/8, f/11, and so on. By moving the pointer to one or other of these you fix what is called the aperture of the lens, that is, the size of the opening, and, therefore, the amount of light allowed to enter. They are so arranged that each allows roughly double the amount of light of that next to it. Thus an aperture of f/4.5 allows twice as much light as an aperture of f/6.3. But by varying the aperture you not only alter the amount of light allowed to enter, but also affect what is called the "depth of focus." If you photograph an object six feet away from the camera with an aperture of f/4.5 you will find that objects a little nearer or a little farther away than six feet are out of focus, whereas if you use an aperture of f/6.3 you will find more objects in focus, and with an aperture of f/11 there will be still more in focus.

Generally, the smaller the aperture, the greater the depth of focus.

If the weather is dull you will require a wider aperture, or a longer exposure. A great deal depends upon the nature of the object you are photographing. If that object is moving rapidly you obviously want as short an exposure as possible, so that it does not produce a blur on the photograph, and so you must alter the aperture to suit the light. On the other hand, if you are



SECTION OF A REFLEX CAMERA

Above is shown the mechanism of a typical reflex camera. The parts marked are: P, plate holder; B, revolving back; F, focal-plane shutter; M, hinged mirror; G, ground glass focusing screen; H, viewing hood; L, lid covering hood when folded; R, rising front; S, sky shade; T, rack; V, pinion.

photographing a landscape you will usually want a good depth of focus, and, therefore, must use with a box or folding camera a small aperture ($f/8$ or smaller) altering the exposure to suit the weather. For general purposes and with standard film an aperture of $f/8$ and an exposure of $\frac{1}{125}$ sec give good results in bright sunny weather, and you might—until you are quite experienced in photography—use this aperture and exposure or adapt them to your special needs. In making an exposure of more than $\frac{1}{2}$ sec it is advisable to rest the camera upon some stable object, as it is difficult to hold it steadily in the hand for more than that time.

When you focus your camera upon an object you adjust the distance between the lens and the sensitive film or plate in such a way that the object casts a definite clear image upon the film or plate. In box cameras the aperture is so small (usually $f/11$) that everything that is six feet or more from the camera is in focus. In small folding cameras, as we have seen, the focusing is usually done by means of a scale on which distances are marked. But in larger cameras that do not use a "roll film," it is usually possible to focus visually on any object. For this purpose there is a sheet of ground glass at the back of the camera. By opening the lens and by fixing a dark cloth so as to exclude all other light save that from the lens from reaching the ground glass, you can see an image upon this ground glass. This image is upside down, and represents exactly the image that will be formed upon the sensitive plate or film. By moving the lens nearer to or farther from the ground glass you will bring different objects into sharp definition, or into focus, as it is called. The nearer the object is that you wish to focus upon,



After pulling out the winding knob to release the inner framework, draw out the latter, as above



Breaking the seal, next unwind the first few inches of film inserting the pointed end in the slit in the empty spool. Close back of camera, as below, making sure clip is in position and winding knob is properly engaged



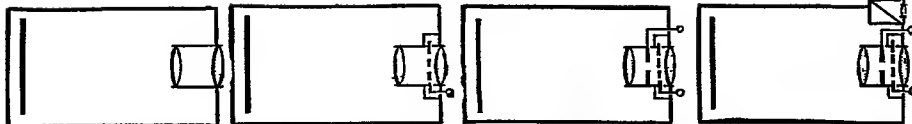
LOADING A BOX CAMERA

The box form camera for roll films is probably the most popular type for the beginner, and it certainly provides, within its limitations, wonderful photographs for so simple a mechanism. The illustrations above show how

to load it with a new roll of film
By courtesy of The Amateur Photographer

the farther you must move the lens from the ground glass, and vice versa. When you have the object or the landscape properly in focus close the shutter, remove the ground glass and replace it by a plate or film, and make the requisite exposure.

In reflex cameras, which are usually the most expensive kind of cameras, the ground glass is on the top of the camera, so that you can focus by looking down on it. There is a mirror in the centre of the camera which throws the image up on to this ground glass. Thus in a reflex camera there is no need to remove the ground glass and replace it with the sensitive plate or film. You merely focus and press the trigger, and this pulls up the mirror—which would otherwise prevent the light from reaching the sensitive plate at the back of the camera—and at the same time makes the exposure. In some small reflex cameras the mirror has a separate lens, and there is no need for it to be raised. Reflex cameras often differ from other cameras in the manner of adjusting the exposure. In most small cameras, as we have seen, the exposure is adjusted by an arrangement on the lens front, which determines how long the shutter will remain open. But in many reflex cameras there is what is called a focal-plane shutter. This device consists of a roller-blind with a slit across it which runs in front of the plate and as close to it as possible. Exposure is altered either by varying the width of the slit or by varying the speed at which the slit passes across the plate. When you press the release to make an exposure, you cause a spring to pull up the blind, and in so doing the slit passes over each part of the film. Assuming that the spring pulls the blind at a constant speed,



1 Lens projects image on film, box serves to exclude other light and hold things in place

2 To exclude light from lens until required to form picture, a "shutter" is affixed to the lens

3 Variations in the power of daylight require "stops," which regulate the light admitted

4 In order to aim correctly we have a second, minute camera built in—a view-finder



5 In order to be able to take more than one picture, we have a long strip of film

doubling the width of the slit will double the exposure. With some shutters both width of slit and the tension of the spring can be varied, giving a wide range of exposures. Focal-plane shutters are favoured by press photographers and others who photograph fast-moving objects, since they allow exposures as short as $\frac{1}{1000}$ second to be made.

We may now consider briefly the sensitive surface of the celluloid film upon which the actual

photograph is taken. Plates and films are fundamentally the same, each being coated with a silver salt sensitive to light, or rather to the actinic rays in light. They differ only in their methods of use. The film is usually fixed on two spools, and when one part of the film has been exposed you wind that part on to the spool before exposing the next part. When the film has all been exposed it is wound completely round one spool. With plates, on the other hand, each has to be loaded into a special plate-holder, which is inserted into the back of the camera, and when one plate has been exposed another plate, in a separate plate-holder, must be inserted. A "film-pack" consists of a number of sheets of film arranged in a holder so that they can be used like plates.

Ordinary films and plates are less sensitive to red than to the



INSIDE DETAILS OF YOUR CAMERA

The diagrams at the top explain in simple manner the functioning of the main parts of a camera. The two photographs show, left, a roll of film and the manner in which it is attached to the backing paper which protects it from accidental exposure to light, and, right, how the film and backing paper lie in the camera. Note how each section is numbered.

Diagrams and photos by courtesy of The Institute of Photography

other colours, and can, therefore, be developed in a "dark-room" by the light of a red lamp. Special films and plates called "panchromatic," on the other hand, are extra sensitive to red and yellow as well as other colours, and, consequently, must not be exposed even to the red light of the dark-room. They are not quite so sensitive to green, and sometimes they are developed by a feeble green light. Panchromatic films are used

very widely to give better renderings in black and white of the colours of natural objects. They are also much faster, so that shorter exposures can be given. Recently films have been made which are specially sensitive to infra-red rays—that is, to the rays of the spectrum below red, which are quite invisible to the eye. These plates are used for scientific and industrial purposes.

Even among ordinary films and plates there are differences,



MINIATURE CAMERA

This camera, a Leica miniature, is made like a scientific instrument and can be used for almost any imaginable purpose. It takes on one spool 36 photographs a little larger than postage stamps which can be enlarged 150 times or more.

PHOTOGRAPHY

of size, etc. Cameras are usually distinguished by the size of the films or plates they take. These sizes are generally given in either inches or centimetres, but three sizes among them are usually referred to as "whole-plate," "half-plate," and "quarter-plate." These terms denote the sizes $8\frac{1}{2}$ by $6\frac{1}{2}$ ins., $6\frac{1}{2}$ by $4\frac{1}{2}$ ins., and $4\frac{1}{2}$ by $3\frac{1}{2}$ ins. respectively. The larger sizes are mostly only used by professional photographers, while "quarter-plate" and $2\frac{1}{2}$ by $3\frac{1}{2}$ ins. are the sizes most popular with amateurs. Within recent years there has been a great development of very small—"miniature"—cameras, taking photographs little larger than a postage stamp on strips of cinematograph film. These have to be enlarged when printed.

Measuring the Speed of Exposure

Films and plates differ in their general sensitiveness to light. Some are much more sensitive than others, and, therefore, require a shorter exposure. You can usually get an idea of the "speed" of a film or plate by the information printed on the outside of the packet in which they are sold. This information, usually, a number, is based in England on a system invented by Hurter and Driffield (hence the letters H. & D.) to measure the sensitiveness of plates of different rapidities. Other systems are "DIN" and "Scheiner," extensively used in Continental films.

When the film or plate has been exposed it has next to be developed and printed. Many of us are content to take it to a chemist's to have that done, but for those who have the time and the means it is good fun to do one's own developing and printing. Two solutions are necessary, one for developing the plate or film and the other for fixing it, and abundant water. The easiest way to make the solutions is to buy the chemicals in tablet form and dissolve these in the stated amount of water.

Films are best developed in the developing tanks specially made for the purpose. The best method for the amateur in developing both films and plates is the "time and temperature" method. It is also the only system adopted by the photographic works that develop and print ("D & P" as it is called) the hundreds of thousands of amateur snapshots taken every summer. The film is unrolled in the dark-room (unless the tank is a "daylight loading" one), placed in the tank and left there for an exact period which depends upon the temperature and kind of developer used. Instructions are given with the developer and the tank. Plates may also be developed in tanks, or they may be developed by hand in the dark-room. This is a method requiring considerable experience and is falling out of use.

What happens in the tank or dish is that as development proceeds the image becomes gradually visible upon the plate, and when it is fully developed the plate is removed from the developing solution, rinsed in water, and plunged in another dish with fixing solution until the negative loses all the creamy substance and is quite transparent except for the picture. When it has remained there for several minutes it is taken out, washed in running water, and is then set aside, in a place free from dust, to dry.

In producing the finished print from the film or plate different kinds of paper may be used. Some papers have a smooth surface, others a grained or "matt" surface, and some papers show more gradation of light and shade than others. In P.O.P. or Print-Out Papers the actual formation of the image on the paper may be watched, but with bromide or "gas light" papers the image is not visible until it has been developed as the film was, and, like the film, both kinds of paper must be fixed in "hypo" and thoroughly washed. Besides "contact



MAKING A PHOTOGRAPHIC PRINT

The photograph on the left shows a film negative developed, but not yet fixed. The creamy substance which the developer has not darkened has to be removed by a fixing bath, leaving the film transparent except for the picture (centre). The right-hand photograph shows a print being made on "gaslight" paper, by the light of an electric bulb.

Photos: David Christie

PHOTOGRAPHY

printing," that is, printing by exposing the paper in contact with the plate or film, you can, by using an enlarger, throw the light through the plate or film on to the paper, and thus get an image much larger than that on the film.

There is so much to be known about photography that it would be quite impossible to deal adequately with any or all of the aspects in one article. Mistakes at first are inevitable, but the main thing to try to do is to benefit by your mistakes, learn how and why you made them, and avoid repeating them. And, whenever possible, do not hesitate to seek advice from an expert. Some boys and girls may even consider photography as a career. There are three principal kinds of professional photographers: the press photographer, who supplies photographs to the illustrated newspapers, the commercial photographer, who is closely associated with advertising, and the portrait photographer, who works in a studio. For all a professional training is necessary.

Photography has now been adapted to serve many practical purposes, and its applications are almost innumerable. The camera and the aeroplane are now used in mapping out districts from the air, especially districts where actual measurements would be difficult, and in this way much time and money are saved. In the detection of crime photography plays a large part, and there are expert photographers at all large police stations. It has revolutionized the study of astronomy, and there is on foot a scheme—begun in 1887 and not yet completed—to map the whole of the sky by means of photography. By using a camera in conjunction with a microscope—or photomicrography, as it is called—very small objects can be photographed, this has proved a great boon to bacteriology and similar sciences.

Photographs in real colour can now be made fairly simply and without great expense by



THE OLDEST PHOTOGRAPH
In 1835 H. Fox Talbot made the photograph reproduced above. It was produced by the famous inventor's Calotype process and is the oldest direct photograph in existence. The subject is a window in Talbot's house, Laycock Abbey, Wells.

the amateur, mainly as transparent films which are projected on to screens like a home cinematograph. They can be taken as easily as ordinary snapshots and give beautiful colours far more close to Nature than was possible before even as recently as 1936. Two of the colour films, Kodachrome and Agfa-color, can be used in amateur cine cameras as well as in miniature (still) cameras, others like Dufaycolor can be used as ordinary roll film or as flat films of various sizes. Colour prints on paper can also be made by several processes (as, for example, by that illustrated in the plate facing this page), but these are more expensive and difficult.

The early history of photography is no less interesting than the latest developments.

The first men to make permanent photographs were the Frenchmen Nicéphore de Niepce and Louis Jacques Mandé Daguerre. Daguerre (1789-1851) became quite famous, and the plates that he produced are still known as daguerreotypes. In 1841 Fox Talbot, the first English photographer, patented the process of making what he called "calotypes." Many of his "calotypes" are still in existence. Photography was still a laborious process, since until long after Fox Talbot's time it was necessary to employ the "wet plate" method, mixing up the sensitive silver salt in the dark and coating the plate with it, and then exposing, developing, and fixing it before the solution had time to dry. Yet in spite of such difficulties, and appar-

atus that was crude and unwieldy, the early photographers produced some work that can compare with anything done since (see, for instance, in page 3223 D. O. Hill's photograph made in 1845).

About 1880 the modern dry-plate process was invented and eight years later George Eastman introduced both the roll film and the first Kodak. Thus came photography more or less as we have it today.



IN PHOTOGRAPHY'S EARLY DAYS

Photography from about 1850 to 1880 in the days of the wet plate needed considerable enthusiasm and a bulky equipment, for the photographer had to prepare his plates himself just before he used them. This drawing shows a photographic camp of 1876.

Science Museum, South Kensington

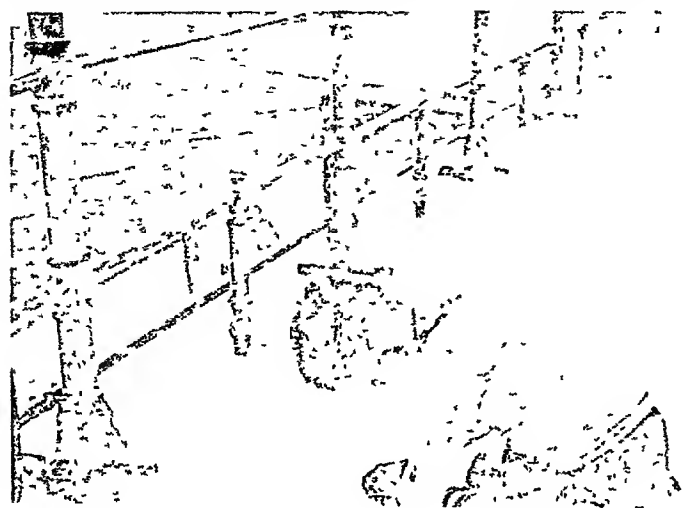
A TRIUMPH OF MODERN COLOUR PHOTOGRAPHY



This "instantaneous" direct-colour photograph was made with an ingenious camera which divided the light coming through the lens into three beams which passed through three colour filters (complementary to the three primary colours red, blue, and yellow) on to three separate negatives at once. Powerful lighting and extremely sensitive plates enabled this effective print to be made

To Int. page 3221

VARIED ASPECTS OF CAMERA CRAFT



PERFECT PORTRAIT WITH A 'MINIATURE' CAMERA



This fine portrait study was taken with a miniature camera, the Contax II. The original negative (reproduced in the inset on the right) is very small, but so good are the lenses of these cameras and so very exact the focusing that enlargements can be made to almost any size without perceptible loss of quality.

"Modern Encyclopedia of Photography" Price Photo, Henry G. Russell



MASTERPIECE OF A PIONEER PHOTOGRAPHER



David Octavius Hill was a portrait painter who took up photography in the 'forties of the last century, and despite the crude quality of the material then available turned out portraits that have seldom been surpassed. This portrait of Robert Spencer Rantoul, printed from the original paper (Calotype) negative, dates from 1845

Courtesy of J. Craig Annan

HOW 'INFRA-RED' PENETRATES DISTANT HAZE



The wonderful photograph on the left, taken by infra-red rays from the side of Ben Vrackie, in Fife, shows a panorama extending for 50 miles, with the Glencoe mountains in the distance. Above is a marvellous photograph taken, also by infra-red, from a height of 18 000 feet, showing the whole of the Isle of Wight on one negative. Details of the countryside are clearly visible, for with infra-red filters the haze which blocks vision is easily penetrated by the camera.

Photos: top, *The Times*
left, D. H. Bradford

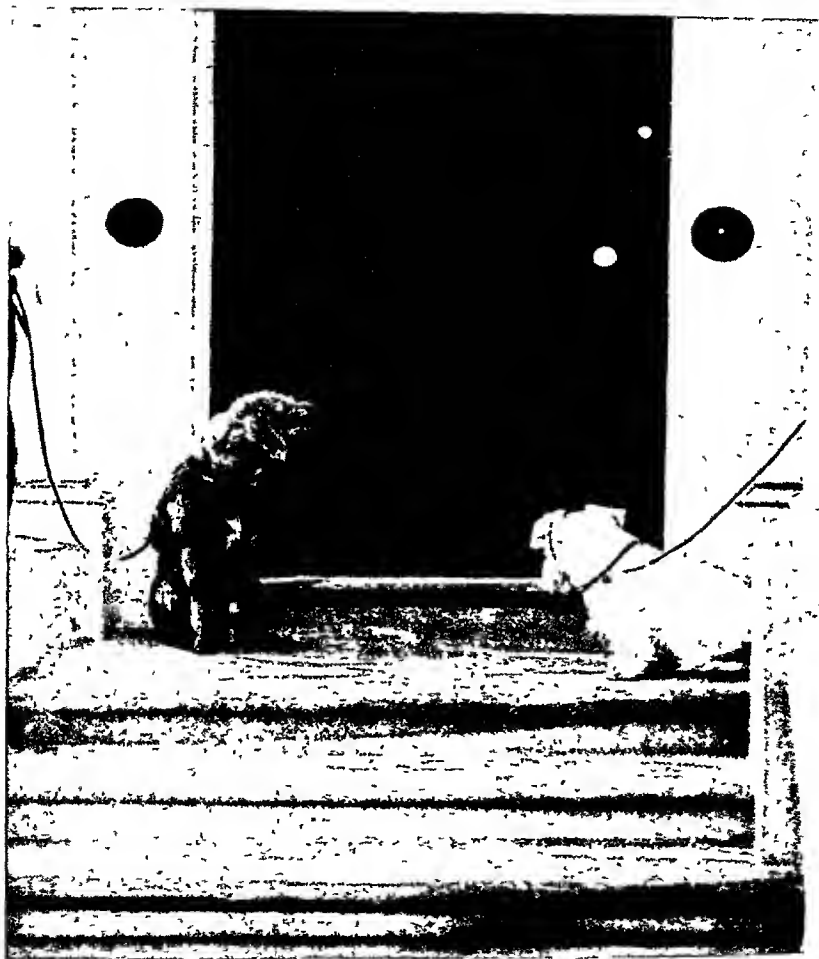
TWO MARVELS OF HIGH-SPEED PHOTOGRAPHY

On the right is an amazing photograph of a bat in flight, taken by means of an exceedingly powerful electric spark which lasted for just $1-100,000$ th part of a second. Such a photograph would be unobtainable by ordinary means owing to the creature's swift movements. Below is another example of high-speed photography, showing a cup of coffee dropped on the floor at the moment of impact and breakage. The exposure given was $1-75,000$ th of a second.

Photos by E. E. Ebertson and William D. Tucker in courtesy of the Massachusetts Institute of Technology



A STORY 'SNAP' ANY AMATEUR COULD TAKE



This photograph, aptly entitled "Waiting for Master," is an example of a subject which could be taken by any amateur photographer who goes about with his eyes open and has a flair for what will make a good photograph. The attitude of the dogs tells a story clearly, and the composition is exceedingly attractive.

"Modern Encyclopedia of Photography" Photo Photo E. F. Bush

THE BRIDE 'SNAPPED' FOR THE DAILY PRESS



With what wistful eyes the little girl is gazing upon the society bride in her lovely gown, just leaving her father's house on what is the happiest day of her life! Editors know that all the feminine world is interested in a wedding, and such photographs as this are a regular feature in most of our newspapers and illustrated periodicals

Photo F. J. Berger

SKATER'S FLIGHT 'SHOT' BY THE FLASH-GUN



For the taking of action photographs at night it is best to employ what is termed a flash-gun. This consists of an electric bulb and reflector synchronized with the camera shutter in such a way that a powerful light is produced at the exact instant the shutter is opened. The photograph shows Angela Anderes, the champion skater of Switzerland, and was taken with a Contax camera and Kalart flash-gun.

Photo Lancelot Young A.P.S.

Phrenology. You sometimes hear about people "having their bumps read." This strange branch of science derives from the work of Franz Josef Gall (1758-1820), a German physician, who, more than 100 years ago, developed into an elaborate system the theory that the functions of the mind are closely connected with certain areas of the brain. He mapped out the brain into 26 definite regions, and taught that each of these is the origin of a definite "faculty," or mental or moral disposition. Gall further believed that the relative development of these organs is manifest in the shape of the skull. Thus by measuring the skull and charting its "bumps" and depressions, one could discover to what degree an individual possesses the various "faculties," and so read his character. "Phrenology" (from the Greek

words *phren* meaning "mind," and *logos* meaning "science") was the name given to these teachings. Other writers expanded Gall's system until they had charted 43 so-called "faculties."

Phrenology was introduced to Britain by another German doctor, Johann Gaspar Spurzheim (1776-1832), who had studied and elaborated Gall's system. Then a Scotsman, George Combe (1788-1858), acted for years as a missionary of phrenology, writing several books on the subject which for years had wide circulations. More recently Dr. Bernard Hollander raised phrenology almost to the level of a science. Today, however, the opinion seems to be that even though certain parts of the brain are concerned with particular functions, there is no proof of any kind that they are revealed by "bumps" on the skull.

'PHYSICAL JERKS' for YOUNG and OLD

Getting and keeping fit in body and mind occupies a large amount of every one's leisure in these days of artificial and unhealthy living and working conditions. The value of exercise is explained here.

Physical Training. In earlier days people maintained their health and strength without a thought of special exercise, but now conditions are changed, for so many people are engaged in sedentary or "sit down" jobs in which they get little or no opportunity of exercising their muscles. "P. T." does not attempt to produce trained athletes, for too much exertion is sometimes as dangerous as none, but it does aim to produce and retain normal health for those whose working lives are largely sedentary.

Many exercises can be performed anywhere without gymnastic equipment, but pure air is always important. Such exercises should be practised daily and at regular times if possible, but never within two hours after eating or one half hour before. The best times are between 10 to 12 in the morning, or 4 to 6 in the afternoon. Very good results may be obtained by practising for 15 minutes in the morning on getting up, and gentle exercises may also be taken with benefit at night before retiring. It may be remarked here that P. T. is

quite useless, unless the exercises are carried out with the full concentration of body and mind.

In addition to such exercises there are others called "gymnastics," performed in an indoor "gym" with apparatus. (See *Gymnasium*.)

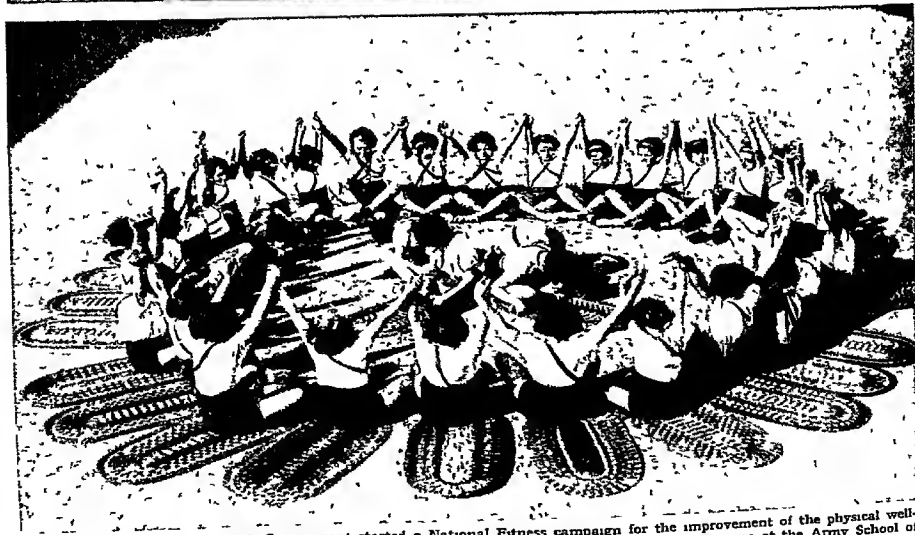
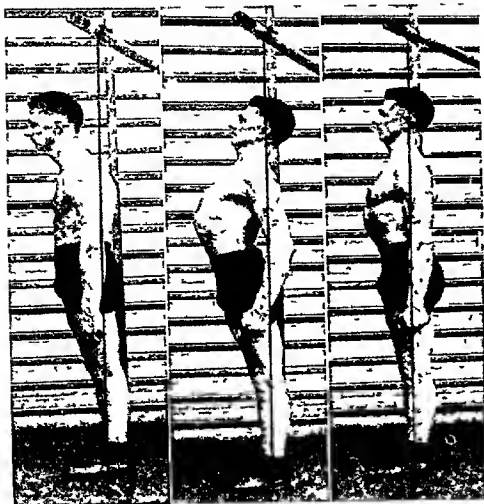
In 1937 the British Government inaugurated a National Fitness Campaign designed to improve the physical well-being of the nation. Britain had fallen behind other countries, notably Germany and Sweden, in this side of bodily education, and her younger generation was criticized as being of only "C3" standard (the highest standard is A1).

Under the Physical Training and Recreation Act of 1937, a National Advisory Council for



PUTTING THE SMILE IN 'SIDEWAYS BEND'
These little girls seem to be thoroughly enjoying their exercises in Dundonald Park, Wimbledon, under the watchful eye of the Corporation's physical training expert. Like Wimbledon, many local authorities have appointed special physical training instructors in response to the Government's "Keep fit" appeal issued in 1937.

'FITNESS FOR ALL'—THE NATION'S NEW MOTTO



It was in 1937 that the British Government started a National Fitness campaign for the improvement of the physical well-being of the nation. Our photos show top left, 1, how a new recruit looks when he arrives at the Army School of Physical Training, Aldershot, 2, the "stance" or posture he would probably acquire if admitted direct to a regiment, and 3, correct stance after proper training. On the right English schoolboys are seen at "gym" practice. The lower photograph shows children of a Salford school exercising in the open air on small mats

(holos top left heystone top right and bottom Fox holos

SIMPLE EXERCISES FOR KEEPING YOURSELF FIT



1, Marking time this should be done slowly at first, gradually increasing speed until it resembles a stationary run. It should be carried out on the toes, and the back kept hollowed. 2, Knee bending the hands are kept on the hips and the exercise done on the toes. 3, Lunging the movement is made with right arm and right leg and then with the left. 4, Shadow boxing. 5 Two chairs as parallel bars With the weight resting on the arms, the legs should be raised as nearly horizontal as possible. This strengthens the abdominal muscles. 6, The arms are bent until the chest touches the floor, and then straightened. The movements should be carried out slowly, and the back should be kept straight throughout.

PHYSICAL

Physical Fitness was formed, including many leading representatives of various branches of sport. Local area committees were appointed in all parts of the kingdom, and grants for the provision of physical instruction are made to big voluntary organizations like the Boy Scouts, the National Association of Boys' Clubs, and the Y M C A. Moreover, there is provision for a National College of Physical Training, where men instructors will be trained, there are already several schools for women instructors.

Anything in the nature of compulsory P T is frowned upon by the authorities as smacking too much of the methods adopted by the Continental dictators, and it is intended that such training should only supplement the playing of regular games.

Many schools include P T drill in their daily curriculum. It is much easier to practise and perfect exercises in a class under a qualified instructor, for the timing and rhythm of the movement then comes much more naturally.

PHYSICS

In recent years a great deal of attention has been given to the study of posture, not only for the sake of appearance but for the sake of health and efficiency. Good posture is essential to proper adjustment, physical and mental. Poor posture cramps the vital organs, hastens fatigue, and stores up body poisons.

To stand properly and easily you should relax your knee muscles enough to avoid strain and rest the weight of the body firmly on both feet. The abdominal muscles should be held firm, the chest up (but not enough to cause the lower back to curve greatly), the shoulders relaxed, and the head erect.

In walking, the same general rules for posture hold. One should walk with the toes straight ahead and always wear comfortable shoes.

In sitting, one should be well back in the chair, with both feet squarely on the floor. The upper back and neck should not bend, one should bend forward from the hip joints. Sitting with out change for a long time is tiring.

MOTION and MATTER in the UNIVERSE

"How does it work?" This is always our first question about a machine. It is physics that tells us, explaining also how the whole world works and the laws of Nature which it must obey.

Physics. What would our 20th-century civilization look like, seen through the eyes of an unspoiled savage, such as Columbus carried back with him to Spain? Most of the changes which would greatly impress him are the result of the far-reaching discoveries in physics.

What is physics? The word is derived from the Greek word for "Nature," and physics is the answer to the questions that men ask about natural "phenomena." Such natural phenomena as water running downhill, sound travelling through the air, the heat coming from a fire, and the different colours of different objects, need an explanation. They are real problems to the physicist, although they appear perfectly natural to most people. For a long time the answers were assembled as "Natural History" or "Natural Philosophy." Gradually, as these answers were sorted out and classified, a number of individual sciences—astronomy, geology, botany, zoology, and others—were defined.

Chemistry (*g v*) is the name we now give to the science of matter, its atomic constitution and molecular relations and transformations. Physics is the heir to the "undivided residue" of the estate of Natural Philosophy, and is the mother of a whole family of subsidiary sciences—mechanics, which is the science of

motion, mass, force, and the mechanical properties of matter, solid, liquid, and gaseous (see Mechanics), acoustics, the science of sound (*g v*), the science of heat (*g v*), optics, the science of light (see Light), and electricity and magnetism (see Electricity). The application of the principles of physics to explain the way in which chemical changes take place has given rise to the science of *physical chemistry*. As applied to the problems of living matter, the science of physics is known as *bio physics*. In the study of, say, the

By mixing the marble and acid at the left, one turns them into other substances. But the mass (or weight) of the new substances is the same as that of the old, for by the law matter cannot be increased or destroyed.





mechanism of vision, the scientist finds he has to call all these sciences to his aid. We must bear in mind that all are closely interwoven and are grouped in this way only for our own convenience.

Many words in everyday use are given a special meaning by physicists. We often use the word *velocity* as though it meant "speed," but in physics it means "speed in a definite direction." For example, a car might be travelling up the Great North Road at a speed of forty miles

per hour. Then its northward velocity would be forty miles an hour, but its velocity east or west would be zero. The earth travels round the sun at a fairly constant speed, but its velocity is always changing, because it is travelling round a circle and not in a straight line. The rate at which this change of velocity takes place is called *acceleration*. The earth accelerates towards the sun although its speed through space is constant. The car accelerates northwards when its speed is increased to fifty miles per hour. Now, what is the cause of acceleration? Physicists call it a *force* and define it as any external action which tends to set matter in motion, or to change any motion which already exists. The force which you put into kicking a football is measured in terms of the sudden acceleration of the ball and the mass of the ball. Now, the term mass does not mean the same thing as *weight* in physics.

Weight is but one aspect of mass, and depends upon the gravitational attraction of the earth for the piece of matter concerned. Weight is simply a method by which we compare the



PUTTING PHYSICS INTO PRACTICE

The engineer who built the girdered structure at the left, the metallurgist who planned the steel-making process at the right and the professor lecturing to a class on the laws of matter and energy in the middle picture—all three are servants of the great science of physics. The professor in this case is the famous Niels Bohr, and the calculations behind him on the blackboard deal with the structure of atoms.



masses of different bodies. It may change, but mass, being the quantity of matter in a body, does not change. We know, for example, that a lead bullet will weigh a little more at the surface of the earth than it will five miles in the air, for the gravitational attraction is less. If it were possible to reach them, there are places in space where the bullet would weigh nothing, because the gravitational pull of the earth upon the bullet would be offset by that of

other planets and the sun. But the quantity of lead in the bullet—its mass—would be unchanged. Fired from a gun, it would strike its target with the same force as it possesses at the earth's surface.

Inertia is another important aspect of mass. It is the inertia of matter which resists any attempt to start it when it is at rest, to stop it when in motion, or to change either the amount or direction of its motion. It requires an external force to overcome inertia. We measure inertia in terms of the mass of matter.

All science depends and draws upon the laws of physics. Its first hypothesis—that natural phenomena are not wayward and capricious as they seem to the untrained eye, but work in a regular way, following what men call "laws," which can be discovered by patient study of their operation—is the very foundation of all scientific thought.

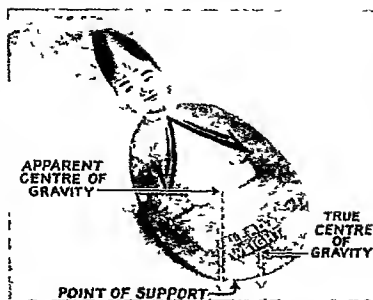
The constancy in natural phenomena found its first magnificent, all-embracing affirmation in the declaration that the "law of gravitation" (see *Gravitation*) held true throughout the universe.

One of the older principles of physics is that mass cannot be altered. This is called the principle of the *conservation of mass*. If a lump of coal is burned, this principle asserts that the total mass of gases, ash, and other substances produced is exactly equal to the original mass of coal, plus the mass of oxygen from the air used to burn the coal. In other words, the form of matter can be changed, but matter cannot be destroyed, nor can its mass be increased or diminished.

Momentum is the quantity of motion, and is measured by the product of mass and velocity. A one-pound cannon ball, moving 2,000 feet per second, and a 2,000-pound weight moving one foot per second, have the same momentum, because the product of the speed and the mass of each is the same figure. Momentum involves the idea of energy, for the cannon ball would not have had momentum unless energy had been applied originally to move it, and to stop it energy must be applied. Stopping the cannon ball requires that energy be absorbed from the moving ball—for example, by the crushing of the wall against which it hits.

The wall receives the momentum of the ball and so no momentum is lost. This is in accordance with the law of *conservation of momentum*.

Just as matter can be neither destroyed nor created, so energy is constant in amount according to the principle of the *conservation of energy*, though it can be extracted from a pound of coal, for instance, and added to a quart of water, as when the coal is burned to boil the water. The process cannot reverse itself—the energy will never run back from the water to rekindle the coal out of its ashes and smoke. The transformations of energy are



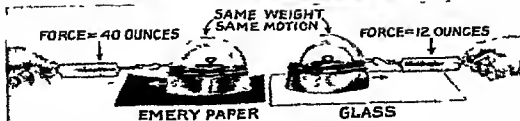
WHY HE WON'T LIE DOWN

An object tips over as soon as its centre of gravity falls "outside" the point of support. If its centre were where it appears to be the doll would tip over, but the weight in the base brings the centre of gravity so low that it stays "inside" the base.

table, you would have done six foot-pounds of work. If you did this in three seconds, you would have expended a "power" of two foot-pounds per second. If it had taken you six seconds, your power would have been only one foot-pound per second. You see, power is the rate at which work is done, and implies a time measurement.

The study of energy (qv) leads us on to other forms of energy, such as heat and light, electricity and chemical energy, which are dealt with under Heat, and Spectrum. Studies of these energy-forms and their relations to matter have played an important part in the development of the "new physics," etc. The study of the new physics began when Sir J. J. Thomson discovered that atoms were not indivisible particles, but were composed of electrical energy (See Atom and Atomic Theory). Skilful scientists have now developed a machine known as a Wilson Cloud Chamber which enables them to see and photograph the movement of these "atoms of energy."

From all discoveries such as these scientists have been led on to believe that light cannot always be thought of as a wave travelling through the ether. In fact, the theory of relativity (see Einstein)



FRICTION—FRIEND AND FOE

The Redskins used friction to light their fires, by twisting a pointed stick in a notch cut in a piece of wood until flames burst out. Above we see an electric drill giving a modern labour-saving demonstration of this fact. Below is a simple graphic story of how friction consumes power. Yet when properly applied, the frictional property of emery-paper is of course, extremely valuable.

shows that it is unnecessary to imagine ether in the gaps between atoms and electrons. So Newton's "corpuscular" theory of light (see Newton) was given new life under the name of the "quantum" theory (*q v*). But it has been found necessary to think of light as a stream of particles and as a wave motion, at the same time, so such particles have been called "wavicles."

If all this seems puzzling and contradictory to us, we must remember that it puzzles the scientists, too. What has happened is like what would happen to a blacksmith if he tried to work in a jeweller's shop. He would find that "smithy" methods would not do. Until now science has been using large scale methods when it thought it was using very fine ones, in measuring light waves and using microscopes. But now that the scientist can tear atoms to bits, he finds, like the blacksmith in the jeweller's shop, that the rules which worked well for earlier problems are not precise enough to explain the new discoveries. In particular, parts of atoms can be shot into space at speeds comparable to that of light, and it seems that matter can be transformed into energy at these speeds, and that energy has a definite mass. But although the one may be converted into the other the

sum total of both, in the whole universe, remains the same. These ideas may seem startling, but experiments with the new devices—such as the Wilson Cloud Chamber—have yielded many results which could not readily be explained by any other theory.

Physics as a Career

Today there is a wide field open in academic research for the young physicist with a first-class honours degree in this subject. For those not possessed of highly exceptional academic qualifications, however, there are many openings in industry. Nearly every large manufacturing firm has its own physicist, or even a staff of physicists. Manufacturers of electrical goods, and wireless and television instruments, offer particularly good prospects.

Government departments, such as Woolwich Arsenal and the General Post Office, provide many excellent positions. The Department of Scientific and Industrial Research makes numerous research grants in physics and controls the National Physical Laboratory at Teddington.

For those with a second-class degree or a general degree (in three subjects) in physics, teaching offers a profession. But in this case an extra year's training in teaching is essential.

How Physics Affects Our Lives

IN the days of the ancient Egyptians alchemists were searching for the elixir of life that would give them eternal youth. Physics cannot claim to have reached so sublime a goal, but from purely physical research we have inherited wonderful devices such as the microscope, the X ray tube, and the radium "bomb," which have helped Man enormously in his struggle to prolong the days of his life.

On the other hand, in the competition for life, Man has had recourse to the wholesale destruction of his fellows. Many of the discoveries of physics, such as the electric motor, range finder, periscope, and wireless, have had their ordinary uses perverted for the service of modern warfare. Physics has been a great stimulus in the advancement of fighting methods, but, at the same time, the demands of war have intensified the efforts of physical research.

Leisure and Entertainment

However, in the normal course of his peaceful life, physics has made Man's existence happier. The development of lenses has given him spectacles, cameras, and, with the aid of the photo electric cell, "talkies." The telegraph and telephone have saved him many a weary mile, and the electric motor does his work for him.

But we very often want to go further than just making life easier and entertainment cheaper. When Galileo made the first telescope men were coaxed to explore the wonderful mysteries of

the heavens. They began to broaden their outlook and see themselves in proper perspective. In more recent days development of the petrol engine and aeroplane have enabled us to travel fast and cheaply, whilst the invention of the wireless valve and cathode ray tube has helped us to listen in to people we could otherwise never have heard, and to see, by television, places we could hardly have hoped to visit in the short holidays that are granted to most of us.

Besides gradually inventing crude implements based on physical principles, such as levers, ploughs, rollers, and eventually wheels early men must have noticed many natural phenomena, such as the rising and setting of the sun, the apparent movement of the stars, the eclipses, and the seasons. These observations led to the birth of astronomy. At about the same time men began to wonder what things were made of, and what would happen if, say, a stick were cut in half, then into quarters, then into eighths, and so on. Could they go on doing this indefinitely? Or would a time come when they could no longer cut the fragment of stick into two smaller fragments?

Such was the dawn of physics. About 450 B.C. a Greek philosopher, Empedocles, first imagined that matter was composed of four "elements"—earth, air, fire, and water. This was the germ of our present day Atomic Theory. It was very crude, but it was a beginning which was

PHYSICS

further developed by Leucippus and Democritus, and later by Lucretius, the Roman poet. Aristotle added considerably to this theory, although he fiercely attacked the rest of the philosophy of these great men.

At a later date Archimedes investigated all the fundamental laws of mechanics, in his study of objects floating and immersed in water, and the action of the lever and the balance. All this knowledge was considered to be of practical value in the time of the Romans. But in the dark ages it was quite neglected. Not until as

Shortly afterwards, the American, Benjamin Franklin, and Henry Cavendish worked on the first concepts of magnetism and electricity. This laid the ground for the remarkable work of Joule, on the mechanical equivalence of heat and electricity, and Faraday on induction (the basis of the dynamo) and the passage of electrical waves through the ether. Faraday was the first man to liquefy a gas by compressing and cooling it. Doubtless this was a great influence on Clerk-Maxwell's calculations on the movements of molecules. Clerk-Maxwell also worked

on the theory of what we now call wireless waves, and by the end of the 19th century these had been fully investigated by Hertz.

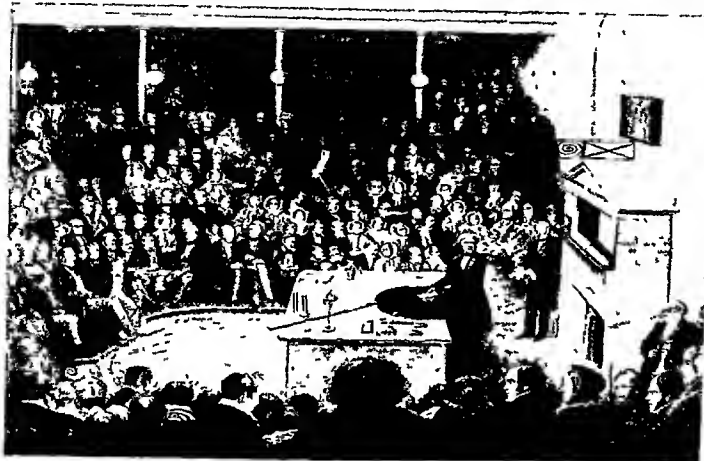
So far we have been able to trace an unbroken chain of outstanding pioneer workers in the field of physics. During the 20th century, however, progress has been so rapid and spread over such wide fields that we must look at these one at a time.

Röntgen's discovery of X-rays in 1895 led Thomson to believe that the atom consisted of "particles" of electricity. The late Lord Rutherford and Bohr have since developed this idea, giving us our complex modern theory of atomic

architecture. The names of Curie, Rutherford, and Blackett are linked by the astonishing work they have done on radio-activity.

Hertz's work on wireless waves was carried on into the present century by Sir Oliver Lodge's work on wireless and the ether. Planck's work on the fundamental laws of the radiation of all kinds of energy forms a connecting link between this early work on the ether and Einstein's more recent theory of relativity.

It would have been most interesting to have lived in the time of Newton or Faraday and to have watched their influence on the thoughts of their fellow men. But we must remember that we are living in the time of Einstein, Planck, Bohr, and Blackett, who are already the outstanding pioneers in the new physics (See the articles on the leading physicists)



PARADAY LECTURING AT THE ROYAL INSTITUTE

The son of a blacksmith, Michael Faraday, the great natural philosopher, chemist, and electrician, began life as an errand-boy. Self-educated, he rose to be one of Britain's most distinguished experimental physicists, to whose commanding genius we owe the wonderful machines for producing the electricity that gives us light and power.

From the painting by A. Blakley

late as A.D. 1600 were Aristotle's ideas finally overthrown by Galileo, who proved in a conclusive experiment what Democritus had merely imagined—namely, that all things fall with equal speed in a vacuum. At about this time Francis Bacon was starting a great movement in favour of experimental research instead of purely imaginative reasoning.

Newton and Gravitation

In the year that Galileo died Newton was born. Newton introduced the entirely new idea of a force existing in the space between all material objects such as the sun and the earth or a house and the one next door, and on this basis he developed his famous Law of Gravitation. He also investigated many of the properties of light, at about the same time that Huygens was perfecting optical instruments.

EXPLAINING the SHAPE of the LAND

How the surface of the land came to have its present form, and how it is still being altered by the same immortal forces, is the subject of the fascinating branch of geography dealt with here

Physiography. Between physiography, geography, and geology there is no sharp line of division. As the term is now commonly used, physiography, which by its derivation means "describing Nature," is the science that deals with the ever changing surface of the earth, and with the relation of air and water to it.

The atmosphere is as much a part of the earth as are the rocks. The study of the atmosphere is called "meteorology," but physiography, even in its narrowest meaning, includes the consideration of the atmospheric forces and processes which have shaped the present surface of the land. This includes the movements of the air (winds), the moisture of the air, especially precipitation, the changes of temperature, and the chemical changes effected, directly or indirectly, through the influence of the atmosphere (See Air, Climate). But while meteorology comprises the study of atmospheric movements as such, physiography in its narrower sense includes

only the effects of those movements on the actual land surface of the earth.

The ocean, likewise, is a part of the earth. The science which deals with the ocean as such is "oceanography," and the consideration of the ocean as a part of the earth falls within the province of geology, while a consideration of the effects of oceanic activities which modify the surface of the solid part of the earth falls within the scope of physiography.

All processes that work on the earth's surface have been grouped into three classes: "diastrophism," "vulcanism," and "gradation." Diastrophism includes the up and down movements of the earth's crust, movements which, however gentle and slow, are continually in progress. Vulcanism includes the activities connected with volcanoes (see Volcanoes). Gradation includes all processes by which material (rocks, soil, water, etc.) is shifted from one point on the earth's surface to another.



LEARNING ABOUT THE EARTH IN A GARDEN SCHOOLROOM

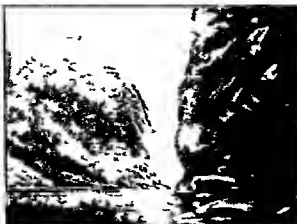
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How much better than a stuffy class-room are the leafy surroundings in which this class is being held! These happy youngsters are pupils at Greater Felcourt School, East Grinstead, to which a 600-acre estate is attached. The teacher's explanations are followed by a practical survey of the land with simple instruments similar to the surveyor's theodolite. In this way physiography and geography are taught in a useful and practical manner by observations of the land itself.

The centres of diastrophic and volcanic activity are beneath the surface. The processes of gradation are in operation on the surface, chiefly at the plane of contact between atmosphere and land and between water and the solid part of the earth beneath it. The transfer of material in gradation is usually from higher to lower levels. Thus rivers carry debris from land to sea. They *degrade* the land, and the material, deposited in the sea, *aggrades* its bottom. Glaciers likewise carry material from higher to lower levels. They degrade the places where they gather debris, and aggrade the places where they leave it. The degradation of one place generally involves the aggradation of another.

The greatest features of the earth's crust are the elevations known as continents, in contrast with the depressions known as ocean basins. The sharp, topographical division-line between continents and ocean basins does not correspond with the borders of the continental land areas. Some distance out from continental lands the water is still shallow. There is then a sudden descent of the bottom to much greater depths. The area beneath the shallow water is the *continental shelf*. Its outer border is usually about 100 fathoms below the level of the sea. From the physiographical point of view the outer edge of the continental shelf is the border of the continent.

It is the province of physiography to define, classify, and explain the origin of all sorts of horizontal irregularities of land areas. Among the horizontal irregularities of the land are peninsulas, capes, etc.—land masses projecting into the sea. Among the horizontal irregularities of the ocean are gulfs, bays, etc.—or bodies of water projecting into the land. The sizes, positions, and shapes of these irregularities are readily expressed on maps, but their origin is somewhat complicated.



FIORDS

When the coast sinks, former mountain canyons become fiords



V-SHAPED VALLEYS

Such valleys are "young," with their sides still unworn by the weather



RUGGED MOUNTAINS

These are still "young" and comparatively unworn by wind, rain, and frost



GEYSERS

These arise when water is turned to steam by underground fires

LAND FORMATIONS AND THEIR CAUSES

They have, indeed, originated in many different ways. For example, the uplift of an area of sea-bottom along a line at right angles to the coast of a continent would give rise to a peninsula. The uplift of two such peninsulas near each other might leave a gulf or bay between them. Again, the sinking of a coast allows the sea to invade the lower ends of the river valleys, forming bays. When the sea converts the lower ends of adjacent valleys into bays, it leaves a peninsula between. Peninsulas and bays formed in this way are the results of diastrophism. Small peninsulas or capes may be built by deposits of sand and gravel made by waves and shore currents. They are the result of gradation—in this case, of aggradation. Volcanic activity on a coast-line may result in extending the land, making a cape.

Physiography has also to do with the vertical configuration of the land. The great relief types are three: plains, plateaux, and mountains.

Plains are relatively low areas of considerable extent, with surfaces which are not notably rough. Plateaux are similar tracts of greater altitude, which stand up more or less prominently above their surroundings on one or more sides. Mountains are usually of less extent, and stand up more conspicuously above their surroundings. They generally have somewhat narrow summits and steep slopes.

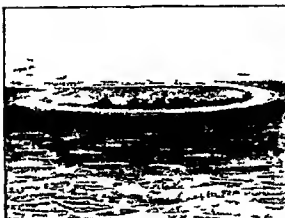
Formerly, plains were often defined as lands below 1,000 feet in elevation, but this arbitrary definition has no warrant in Nature or in usage. The fact is that some plains grade into plateaux, and that there is no sharp line of demarcation or basis of separation which is uniformly applicable. A tract of land 500 feet above the sea would probably be called a plateau if it were bordered on one or more sides by a tract of considerable extent which had an elevation of but 100 or 200

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feet, particularly if the descent to the lower level were abrupt. Extensive areas 1,000 feet or even considerably more above the sea would probably be called plains rather than plateaux, if they were surrounded or largely surrounded by higher lands, while they would doubtless be called plateaux if they stood up distinctly above their surroundings.

Coastal plains, some wide, some narrow, occur in many places along the borders of continents and islands. Many *interior plains* are often much higher than coastal plains. Most of the people of the earth live on plains, because they are more extensive than plateaux or mountains, their climate is more favourable, they have more land fit for cultivation, their rivers are more commonly navigable, and the building of roads, railways, and canals is easier. Coastal plains are likely to have flat, straight coasts with few harbours. Some interior plains are the beds of lakes which have dried up, these are called *lacustrine* plains.

Various kinds of plains are distinguished by special names in various parts of the world. The plains surrounding the Arctic Ocean, where scanty and dwarf vegetation grows on land which is perennially frozen, except for a few inches at the surface in summer, are called *tundras*. Inland in all the continents are vast treeless or almost treeless areas, where the prevailing vegetation is grass, which grows with incredible rapidity during the short summer months. Such plains are called *steppes* in Europe and Asia, *prairies* in North America, *llanos* in Venezuela, *pampas* in the Argentine Republic, *downs* in parts of England and in Australia, and *savannas* in various tropical regions. Most of these treeless plains are without forests because of too scanty rainfall, but trees flourish on many of them if they are looked after while very young.



ATOLL ISLANDS

These are built up by coral polyps in cup-shaped form on rocky foundations



BROAD FLAT VALLEYS

Such valleys are old, filled with debris washed down from their sides



ROLLING MOUNTAINS

Their rounded angles have been smoothed by ages of wear



VOLCANOES

Outpourings of lava and ashes gradually build up cone-shaped peaks

MORE FORMATIONS AND THEIR CAUSES

Plateaux originated in various ways. Some have probably been elevated above their surroundings, in other cases the surrounding land may have sunk away from them, others have been built up by lava-flows. Many of them have a scanty rainfall because the high bordering mountains cut off the rain-bearing winds.

Mountains are the most striking and awe-inspiring features of the earth. Where they rise abruptly to great heights every variety of climate may be found within the range of a day's travel, as in the Andes of South America. No natural feature more profoundly influences human life. They present formidable barriers to travel, and so isolate one community from another. While they have sheltered their inhabitants from invasion and have often become refuges for persecuted peoples, they have also hindered the spread of commerce, of thought, and of civilization. Often they are the headquarters of the stream of life, where the stragglers of humanity live on in ignorance and poverty. Except in fertile valleys, they are not favourable to human life, and few important cities are found in them other than along tourist routes or in mining areas. Mountains also deeply influence the life of neighbouring regions, deflecting winds or robbing them of their rain so that the lands under their lee are always arid and often semi-desert.

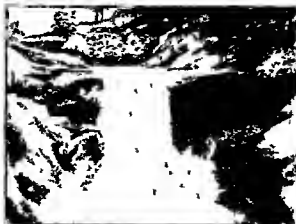
Mountains are not more sharply defined than plains and plateaux. The term mountain implies notable elevation, but a mountain is not necessarily higher than a plateau. Thus the plateau of Tibet is much higher than any part of the Alps.

The term mountain implies (1) a considerable elevation above surroundings, and (2) crests of limited area. An isolated elevation 1,000 feet above its surroundings, rising abruptly above a low lying



'BAD LANDS'

Strange forms cut out by violent rain storms in semi-arid regions



RAPIDS AND WATERFALLS

Usually caused by the wearing away of softer parts of the river bed



SEA CLIFFS

The pounding surf erodes the weaker rock, leaving the coast irregular

flat plain, should properly be called a mountain, though an elevation of the same height with gentler slopes on a rolling plateau might not be

Mountains have originated in various ways by diastrophism, as in the case of mountains formed by the upfolding of the superficial strata of the earth's crust, or by the up-thrust of blocks of the earth's crust by volcanoes, as in the case of volcanic peaks, and by gradation. Lake plains and plateaux, mountains are modified by wind and after they are formed

The great relief forms—plains, plateaux, and mountains—are affected by numerous smaller relief features. Thus, a plain or a plateau may be affected by depressions (valleys) cut out by streams. Between the valleys remain elevations. If the elevations are long and narrow, they are *ridges*; if short, *hills*. The valleys are *made*, the ridges and hills are *left*. As a result of the excavation of valleys, plains may be far from flat. Generally speaking, the valleys are deep in proportion as the land is high. The valleys of plateaux, on the whole, are deeper than those of plains, and the ridges and hills between them are therefore higher. The depressions between mountainous hills have been worn out by running water. It is thus that mountains originate as the result of gradational processes operating on plateaux.

Valleys are constantly being widened. Young valleys are narrow, with steep V-shaped slopes. Old valleys are wide, with gentle slopes. This widening is the result of many causes. Sometimes a stream flows against one side of its channel with such force as to undercut the slope above. The rainwater flowing down the sides carries soil with it, and thus wears down the slope. The soil also tends to slip down by its own weight, especially when it is wet. In some river valleys, however, which are called



GLACIERS

These occur where moisture is constantly supplied to a frigid slope

gorges if they are small and *canyons* if they are larger, the process of deepening has outstripped the process of widening. This happens at considerable heights where streams have great velocity, cutting their way through rock which wears away slowly, and where there is little rainfall to help in wearing down the slopes.

In addition to its work of eroding or wearing away the land, running water also makes changes in the earth's surface by

depositing part of the load of sediment it carries. This usually occurs when its current is checked as at the base of a steep slope. Such deposits are called *alluvial* deposits. Along valley bottoms narrow alluvial plains are often developed, many of great fertility. In such plains natural embankments are often developed. Where a swift stream flows into the sea, its current is checked promptly and its sediment is deposited, making *deltas*, if it is not washed away by the waves and currents. The growth of deltas has created great areas of valuable and fertile land.

Another topographic form is the *basin*. Basins may affect the surfaces of plains or of plateaux, or they may occur among mountains. Some have outlets, and some have not. Those which have not may give rise to lakes, ponds, etc. Ponds and lakes may have outlets, but below the level of the outlet is a basin which has no outlet; otherwise there would be no lake or pond. Other so-called basins are enclosed on three sides and open on the fourth, or at least at some one point.

The configuration of the sea bottom also falls within the province of physiography. While the sea-bottom is less familiar than the land, its general features are known. For example, there are great areas of the sea bottom elevated above their surroundings. Such areas are comparable, in some sense, to the plateaux on land. There are great areas where the

ocean bed is depressed, relative to the areas just referred to. Such areas are comparable to the plains of the land. There are other depressions in the ocean bed, more limited in area, which are comparable to basins on the land, though some of them are much larger, both in area and depth, than the enclosed basins on the land. Many parts of the ocean basin have been affected by vulcanism. Volcanic peaks are, on the whole, more notable features of the ocean-bottom than of the land.

In its fundamental features, therefore, the ocean bed has some likeness to the land. But

gradational agencies, especially degradational agencies, are not operative on the ocean bottom, except in very shallow water. Since it is degradational agencies which produce the most notable secondary features of land surfaces, and since these agencies are little operative in the sea, the sea bottom, in general, is without the hills, the ridges, the mountain peaks due to erosion, the valleys, valley plains, and terraces which abound on the land. These are at times found on the sea-bottom, and the areas where they occur are consequently thought to have been land.

HOW THE HUMAN BODY WORKS

As anatomy tells us the "where" and composition of the various organs of the body, physiology explains their purpose and functions, it is thus one of the most important branches of "body-study."

Physiology. The body of the average man, weighing 11 stone, contains the equivalent of 100 dozen eggs, enough iron to make three or four big nails, fat sufficient for 75 candles as well as a good sized piece of soap, phosphorus for 8,004 boxes of matches, enough hydrogen (in combination) to fill a balloon and carry a man above the clouds, and, besides all this, 10 gallons of water, 6 teaspoonfuls of salt, and a bowl of sugar. This gives us some idea of what we may call the *chemistry* of the human body. Its structure and its way of working are equally wonderful.

Now, if you are going to run a motor-car or a motor cycle you want to know not only what the different parts are, and of what they are made, but you must also learn how each part works or 'functions,' and what its purpose or use is in operating the machine. It is the same when we study an animal or a plant.

Studying the Living Organ

The study of *anatomy* (see *Anatomy*) will tell us the way in which an animal is built and even its minute structure, but it is the study of its *physiology* that tells us how each part functions when the animal is *alive*. And this is not quite so easily learned as the former. For when we attempt to separate the parts in order to examine and study them, we are likely to kill the animal or plant, and the very part which we wanted to examine stops working, so that we have defeated the end for which we strove.

To scientists and physicians this was for many centuries the great stumbling-block. There is still much that is mysterious in human physiology, for even at the present day there are activities of our bodies of which we know little.

In the early days "humours" and "spirits" were supposed to control certain functions, and anatomy, physiology, and medicine were a jumbled mass of facts and fancies. Then men

of deep thought and earnest work began to make independent investigations. The microscope was invented, and they could actually see the blood flowing through the capillaries from the arteries to the veins when the animal was alive, and other activities as well.

Since then our knowledge has constantly deepened and broadened. As a result of experiment and study we have learned that, as regards its functions, every human or animal organ falls into one of certain great groups.

For instance, there are those organs whose function deals with *nutrition*—that is, with feeding the different organs of the body and disposing of its waste products.

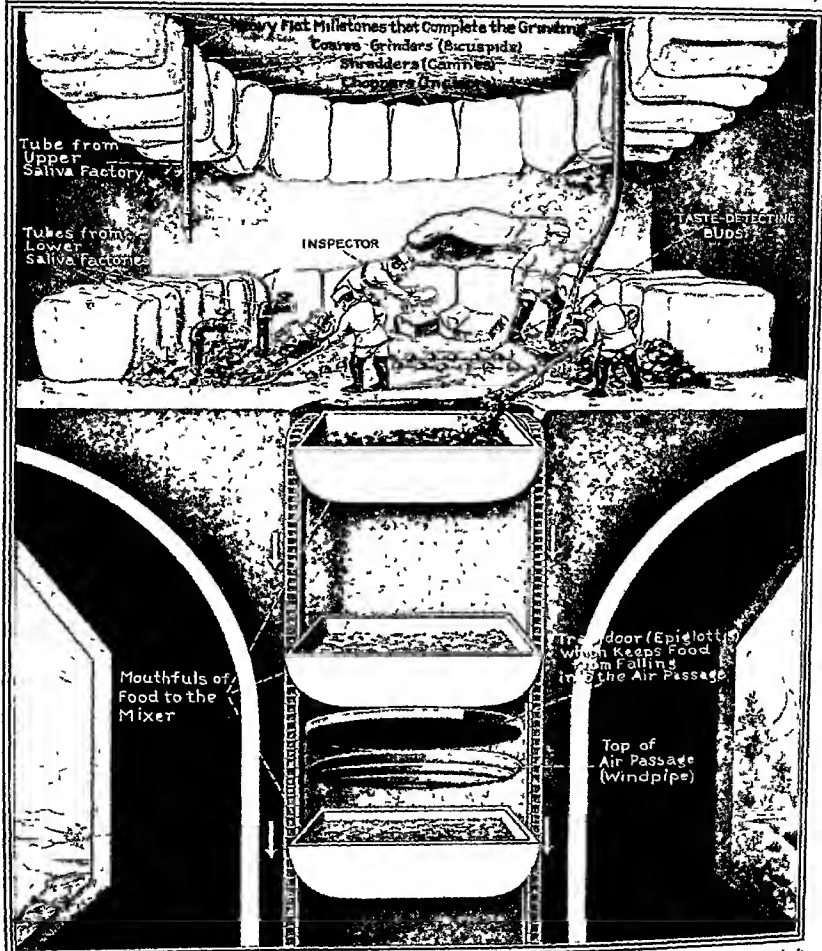
In the work of nutrition, the blood in the animal supplies food to the different parts of the body, the heart pumps the blood, the stomach and digestive system prepare the food so that it may be taken up by the blood, the liver, pancreas, etc., help in the work of digestion, the kidneys aid in throwing off waste products, the lungs take from the air the oxygen which is needed by every living cell of the body and throw off carbon dioxide, and the skin is also active in throwing off waste products.

Links with the Outside World

Certain organs deal with *relation*—that is bring us information of the outside world about us (the eye, ear, nose, organs of taste and touch) and tell us our relationship to it. In this group we may place the muscles, which control our movements and hence our relation to people and things, and also the bones, which support and protect our bodies and are used as tools and levers by the muscles. The business of each of these parts of our bodies concerns our relation to the world of things about us or the interrelation of the parts of the body.

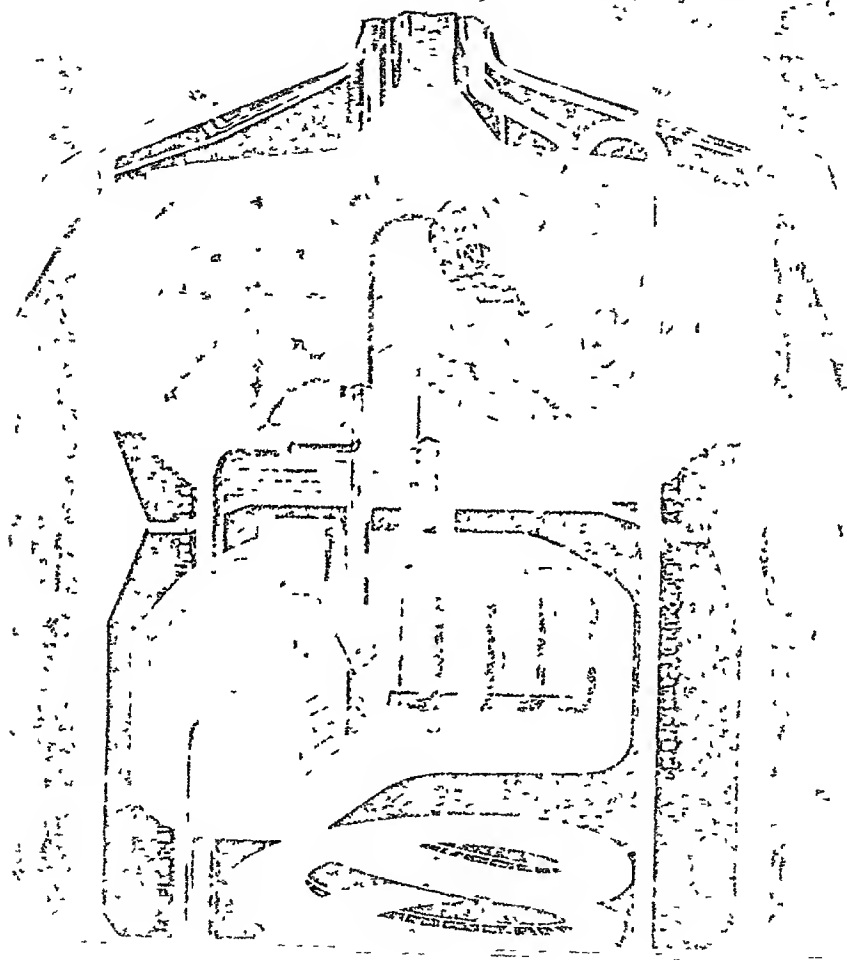
Then there are the organs of *intelligence*, which include the brain and nerves. These

OUR BODY MACHINERY—IN THE GRINDING MILL.



Just as locomotives turn their fuel (coal and water) into a means (steam) for applying energy to their working parts, so does our body machine have a means for turning its fuel (food) into blood for its working parts. This picture shows the grinding mill, where fuel is received and worked into shape for the succeeding processes. The first thing is inspection, just as a grain inspector examines grain at a flour mill, to see if it is up to standard. Thus the mouth inspectors do by tasting it. That's what the taste buds are for. Having passed the inspectors, the food is ready to be ground up. All the food is first ground coarsely, and then finer and finer, just as in the case of wheat in a flour mill. And all this time those tubes are pouring in saliva, which softens the food and partially digests the starches. When the grinding and mixing are finished, mouthfuls of food are started on their way to the mixing room. A special trap door (epiglottis) is provided, which shuts when food comes down, and keeps it from entering the air passage room.

PURIFYING, SEPARATING AND STORAGE ROOMS



receive sensations, store up impressions as memories, make decisions and plans, and transmit suggestions and orders to other parts of the body. The quickness and clearness with which this group functions is considerably affected by the general health of the first and second groups. The old Roman adage, "a sound mind in a sound body," was founded on physiological fact.

Finally, we have those organs whose work it is to reproduce the human species. These are known as the organs of *reproduction*.

Very closely related to the study of physiology is the study of *hygiene* (*q v*). Anatomy tells us how the organ is made, physiology tells us how the organ works or functions, and hygiene tells us how to care for it and keep it well.

Protecting the Body with Knowledge

So closely are these subjects related, and so important is a knowledge of them to our well-being and happiness, that it is well worth while making an effort to understand them. If we know how our eyes are made and how they work, we shall know better how to protect them so that they may serve us faithfully as long as we live. If we know how our bodies are made and how the various organs function, we shall not take into them narcotics or stimulants or any other poisons which injure and break down the parts of these wonderful machines. For we learn that when any organ is not working properly, some other organ must work harder to counteract this defect. Only when every part is doing its work well, can we be healthy and happy (*See Blood, Brain, Digestion, Lungs, Nerves, etc*).

The physiology of plants is in principle the same as that of animals, but is much simpler because the activities of plants are simpler than those of animals and human beings. In the higher plants the root is an organ of nutrition for absorbing water, mineral salts, and organic matter which is soluble in water. The root, leaves, and stems are furnished with strands of tissues along which the water and food travel. The leaves and at times the stem are organs for absorbing carbon dioxide and giving off oxygen, and are also important in helping the plant to manufacture its food.

The flowers and seeds, too, play a large part in the higher plants in ensuring that the species does not die out. In addition, all plants are more or less sensitive to sunlight, moisture, and other chemical influences, so we may say that they have some traces of organs of relation (*See Plant Life*).

Piano. Near the close of the 17th century a wealthy Italian prince of the Medici family hired Bartolommeo Cristofori to take charge of his collection of musical instruments. Cristofori was a harpsichord maker and so was especially

interested in this and other instruments played by a keyboard.

These forerunners of the piano were of two general kinds: (1) the harpsichord type, in which the strings were plucked by quills or pieces of leather that rose and twanged the strings when the key was struck; (2) the clavichord, in which the strings were struck by brass wedges, or "tangents." Virginals, psalteries, and spinets were small instruments of the harpsichord family. Most of them had a small range, with only one string to a note, and were placed on a table for playing, though some harpsichords were large and shaped like a modern grand piano, with two, three, or four strings sounding in unison for a single note, thus increasing the volume of tone. The most elaborate harpsichords had double keyboards—one for producing soft tones and the other for loud tones—with stops and pedals for varying the effect. Some of them were upright, like an upright piano. Usually the spinet was small and each one of its notes had a single string plucked by a crow's quill or a piece of leather. Our knowledge and appreciation of these early instruments have recently been greatly increased by Arnold Dolmetsch, who devoted his life to collecting and making them and to demonstrating their qualities in concert work.

The First Pianoforte

All these instruments lacked means of sustaining tones and were not easily controlled to bring out contrasts of loud and soft. Cristofori set himself to remedying these defects, and in 1709, 1720, and 1726 built instruments which gradually developed into the modern piano. The name piano is a shortened form for "piano forte," given to the new instrument because it could readily be played either soft (*Italian piano*) or loud (*forte*). The essential feature of the mechanism which accomplished this was the use of little leather hammers operated by a hinged lever—as in modern pianos.

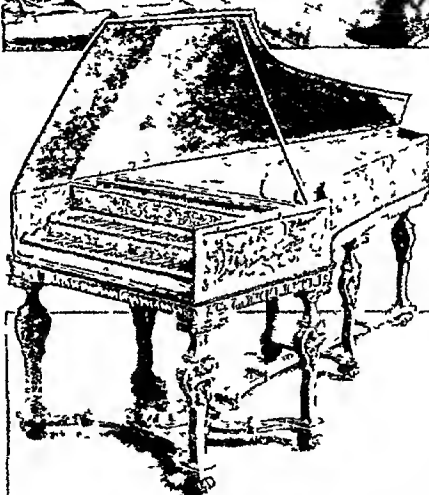
There were, however, many defects in these early instruments, which kept them from becoming generally popular among musicians. Bach, Haydn, and Mozart continued to write for the harpsichord and the clavichord, though Mozart had a piano for his personal use, and it was not until many improvements had been made that the piano was fully accepted. Beethoven was the first great composer to write for the pianoforte.

The wood for a piano is chosen by a workman so expert that he can tell by its sound when it is struck whether it has the necessary qualities of resonance. Then it is weather seasoned for three to ten years, and afterwards artificially dried for weeks.

The case consists of two sides or ribs made up of many thin strips of wood bent to shape and

glued together. They are supported and held in place by posts of heavy timber. These posts and the inner rim form the frame or skeleton of the instrument, over which a veneer of wood is laid. To this frame, at its front end, is attached the "wrest plank" or pin-block, into which the tuning pins are driven.

Over the frame or as a whole is laid the convex or arched sounding board, which is securely fastened at its edge to the inner rim. Over the sounding board in turn is placed a metal plate to hold the strings, which are drawn across the plate from the tuning pins at its front end to hitch-pins at its rear. The positions of these pins are carefully determined so that string tension may be nicely proportioned throughout. The action is then adjusted in such a manner that a felt hammer, upon being brought into play by the depression of its key, strikes a string, or a group of strings in unison, and makes it vibrate.

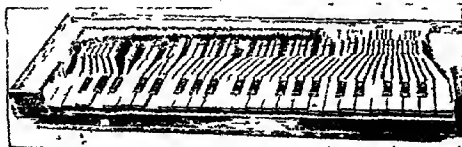


The strings, in being drawn from the front to the rear end of the plate, pass over a bridge, which is glued to the sounding board. Determining the proper height of the bridge is a delicate matter. If the bridge is too high the downward pressure of the strings overbalances the upward pressure exerted by the arched board, if too low, opposite results follow. As the strings are set vibrating by the hammer blows, the vibratory motion is communicated through the bridge to the sounding board, and thereby amplified.

The best way to understand the action is to take out the front board of an upright piano and look inside. Press down a key and you will see how its rear end rises and lifts the "jack," which throws the hammer against the strings while raising the damper from them.

Tone depends on the length and size of the strings, and the resonance space. The concert "grand" of today has three strings (tuned in unison) for each note, except for the very low notes, which have only two, it has a steel frame, the wires are stronger and the heavier strings are wound with smaller wire.

The white ivory keys correspond to the natural tones and are called "natural", the



PREDECESSORS OF THE PIANO

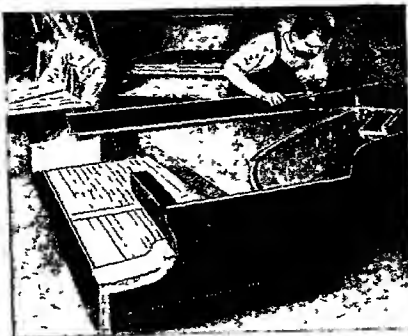
When George Frederick Handel was a little boy, his barber-surgeon father objected to his interest in music. So the lad slipped out of bed at night to practice on a clavichord, a soft-toned instrument, which a friend had put in the attic for him. The top picture, by Margaret Label Duchesse, shows the boy discovered. The elaborate harpsichord in the centre was made by Jan Couchet about 1650.

Below we see a German clavichord of the 17th century.

PIANO

short, raised blackebony keys correspond to the chromatically altered notes and are called "sharps" or "flats." A modern piano has a compass of seven octaves, A to A, or seven octaves and a minor third, A to C. The pedals are levers pressed by the feet to vary the tone. Usually there are two: the soft, pressed by the left foot, and the loud, pressed by the right foot.

The first mechanical piano, or "pianola," was built in 1887. In one type the operator works levers that control the "expression" of soft, loud, sustaining, and time. In the other, the rolls of music regulate all the playing. These are called "master" or "autograph" rolls, for great pianists and composers have signed their names on them to show that they have authorized the playing of the music in exactly the way in which it is recorded.



MAKING READY FOR THE STRINGS

When the sounding-board, with the bridge fastened upon it, has been set in place, skilled workmen drill the holes for the series of pins across which the strings will pass.

The mechanisms of the player-pianos differ in many details, but the basic principles are usually similar. Each note of music is represented on a roll by a small perforation. As this passes over a tracker bar, air pressure is released that causes a hammer to strike a string in the piano. Thus air and perforations take the place of the pianist's fingers.

The piano occupies an important place in the development of music. Beginning with Beethoven, a vast amount of music has been written for it.

alone, and for a combination of piano with stringed instruments and piano with orchestra.

Piano music reached great heights in the music of Schumann and Chopin. Among the great pianists Liszt stands pre-eminent.

The piano is important to most of us chiefly because, more than any other instrument, it



GIVING THE HUGE THROAT ITS 'VOCAL CORDS'

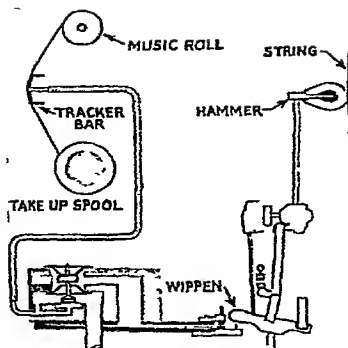
Here workmen are beginning to attach the strings, beginning with the short steel wire strings at the treble end and working up to the heavy strings of the bass overspan with brass. The metal plate and the pegs to which the 220 strings are attached must be very strong, because the united pull of the strings is about 30 tons.

PIANO

offers an opportunity to make our own music at home. On it can be played arrangements of symphonies, operas, and other favourite forms, which would be impossible with any but a keyboard instrument. There is music for four hands on one piano, called duets, and two or more pianos, playing different parts, produce unusual musical effects. We can use it to accompany singing, either solo or chorus, or another instrument like the violin, or we can improvise on it music to suit ourselves. (See also Music)

Picasso, Pablo (b. 1881) "Reality alone, even when concealed, has the power to arouse emotion." On these words Picasso, most influential of 20th-century artists, based one of the most remarkable of the many styles in which he has at one time or another painted

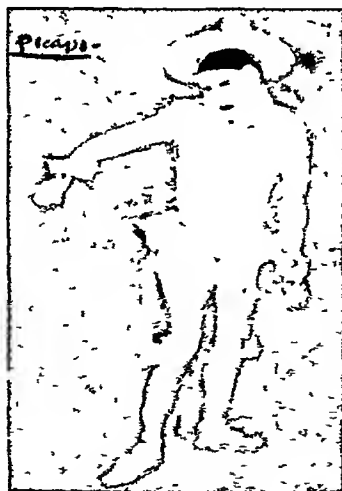
Pablo Picasso was born at Malaga in southern Spain on October 23, 1881, and when he was twenty-two he settled finally in Paris, so that as an artist he is often ranked with the French school. In his earliest work already there was visible his great power as a draughtsman, and the subjects were chiefly poorer people of the Paris underworld. Gradually, however, he evolved the style which came to be known as *Cubism* (defined as the theory of art according to which reality can be expressed only by volumes and their relationship to one another, or, in other words, it is a study of the cubic capacity of things). By 1910 this had been taken up by advanced artists in many parts of the world, and to this strange method of painting was added the even stranger mode, developed especially by Picasso's friend, Georges Braque, of placing pieces of paper,



PLAYER PIANO'S WORKS

When a perforation in the music roll uncovers a hole in the tracker bar, the rush of air between the vacuum chamber and the pneumatic causes the lower leaf to operate the wippen, which in turn throws the hammer against the string.

more intent on keeping "fashionable" than on developing along their own lines, followed him, and he still remained the originator and



PIERROT, BY PICASSO

A most important painter of the 20th century, Picasso, whose original surname was Ruiz, did this "Pierrot" during his early years as an artist. Its simplicity is very impressive. Courtesy of Alex. Reid and Lefevre Ltd.

PIG

metal, and wood on the canvas as part of the picture!

In his attempt really to create the illusion of form in paint, Picasso left Cubism for a completely abstract art, but by the end of the World War period he was once more painting natural objects. Among his works of this next period are some of the greatest masterpieces of modern art, which may well be compared with the finest works by the great Italian masters. Later, however, he took to strange methods of painting which caused many people to doubt his sincerity, the more so as his work became completely unintelligible to almost everyone. Yet the artists of Europe, or at least those who were

the leader of almost every new departure in painting. It is, however, by the work of his earlier periods that Picasso is judged, and it is on account of that work that he is still considered one of the greatest painters of our time. (See also France Art, Spanish Art)

Pig. Jews and Mahomedans regard the pig as "unclean" and unfit for human food. But really it is no more unclean than any other animal, and in its natural state, instead of being dirty, it is exceptionally clean, and will not live in filth if this can be avoided.

Varieties of wild pigs are found on every continent except Australia. Domestication apparently began in China some 7,000 years ago. The domestic pig of Europe is descended from the wild boar of Europe. (See Boar)

Every part of the pig is utilized—the meat for food, the fat (called lard) in cooking, the bristles in making brushes, and the skin

PIG

makes good leather for saddles, purses, and other purposes, though often it is not removed.

Of all animals the pig is the most economical producer of meat, and for that reason it is raised very largely in Great Britain. Four or five pounds of dry feed given to a pig produce a pound of meat, while beef requires from 10 to 12 lb. of the same feed.

Pigs thrive in clean, healthful surroundings, with a good supply of pure fresh water and a variety of wholesome food. While fattening they must be confined to narrow quarters or they will keep thin and wiry.

Among popular British breeds of pig are the Large, Middle, and Small Yorkshire and the Lincolnshire. Curly-coated—all white breeds and, among coloured breeds, the Berkshire, Large Black, and Tamworth.

Pig-raising and pork-packing are very important industries in the United States. The principal pork-packing establishments are at Chicago, Kansas City, and Omaha.

Pigs belong to the family *Suidae*, the scientific name of the European wild boar is *Sus scrofa*. Among other interesting varieties of wild swine are the long-tusked babirusa of the island of Celebes, *Babirusa celebensis*, the African wart-

PIGEONS



DINNER-TIME IN THE PIGGERY

At the top of the page we have a most entertaining photograph of an old sow leaning over the half-door of the outhouse, she surveys the scene with mild inquisitiveness, watching to see if there is any prospect of food. She is soon out of her little house when dinner appears and does not wait to say grace before starting, even ignoring her hungry litter for the time being.

(Photos top P. Stringer bottom Keystone)

hog, *Phacochoerus aethiopicus*, and the African river-hogs, of the genus *Potamochoerus*.

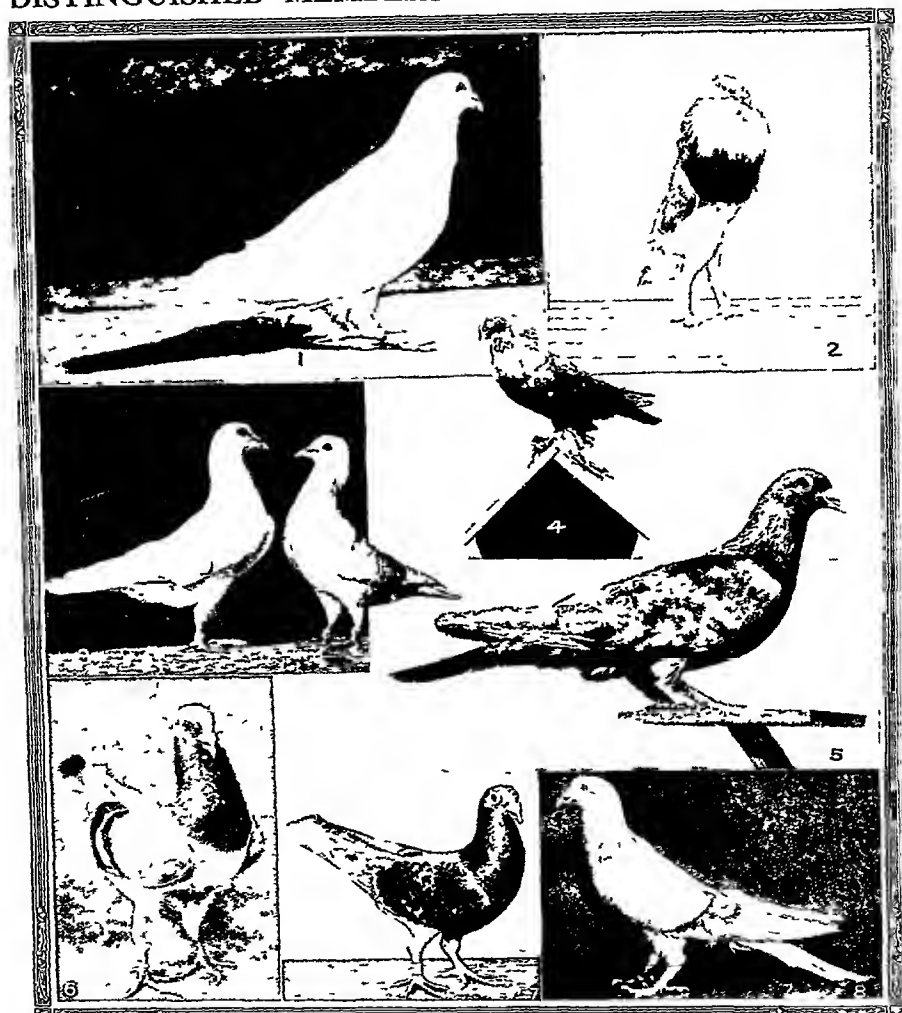
Pigeons AND DOVES The pigeon must have been held in high regard by the early Hebrews, for it is recorded that the poor

were permitted to substitute turtle doves for sacrifice in place of lambs, and the second bird which Noah sent out from the Ark after the Flood's 40 days of rain was a dove.

More than 500 species of wild pigeons and doves—the two words are more or less synonymous—are known throughout the world. They are most numerous in the Eastern Hemisphere. The birds vary greatly in their habits. Some build in trees, others on the ground, some nest in holes of the rock, others on the barest of branches, some live in isolated pairs, others in colonies. However, they all have one mannerism that is theirs alone—in drinking they do not lift the head as other birds do, but take the water in long draughts. The pairs mate for life.

One of the best-known pigeons is the wood-pigeon, or ring dove (*Columba palumbus*), which is common in Britain and most parts of Europe. Wood-pigeons go about in great flocks and do a great deal of damage to grain crops, but this is largely offset by the immense numbers of weed seeds that they eat. They are also very fond of acorns. The bird is easily recognized by the

DISTINGUISHED MEMBERS OF THE PIGEON FAMILY



The White Swiss Mondaine (1) is used principally for squash breeding. The Red English Pouter (2) often "pouts" or inflates his crop with air so vigorously that he falls over backward. The White King (3) is an excellent squash producer. The Black Muffed Tumbler (4) doesn't "tumble." He merely heaves to the Tumblers family. The Red Cornear (5) is famous as a squash breeder. The Hungarian Pigeon (6) is noted for his beautiful markings. The Racing Homer (7) is famous for flying exploits, both in peace and war. Such a thing as a "Giant Runt" seems impossible, but there he is (8). The "Runt" is a corruption of his old Roman name, and the "Giant" was prefixed to show that he is really quite large.

PIGEONS



TOWN-DWELLING PIGEONS OF ALL SORTS

In many towns pigeons are so numerous as to be something of a nuisance but they are also so tame that feeding them is always an amusing pastime. All the same, this little girl at Rochester must have been a bit surprised at the swarm which appeared when she decided to feed the pigeons. They are of all sorts—some white, some dark grey, and many of them more or less striped grey and white.

white "ring" on its neck. In the London parks and streets these birds have become quite tame, and are even fatter and sleeker than country-bred ones. They nest by the sides of the busiest streets, and, when such were available, used hairpins in nest-building.

The stockdove (*C. aenas*), which is distinguished from the ring-dove by having two black bars on its wings, and no white "ring," is fairly common in the south and east of England, and flocks of these birds are often seen in company with wood-pigeons. The name comes from the habit of building its nest usually in the stocks of hollow trees.

Along the coasts of Europe generally, wherever rocks and caves and fissures abound, another species is found—the rock-dove (*C. livia*). This bird is lighter in colour than the stockdove, and smaller, and it is the species from which the racing pigeons have been bred.

The turtle-dove (*Turtur communis*), the emblem of tender love, is found in many parts of England. It frequents woods, especially those in which the trees grow close. It is a migrant, reaching us late in spring, and it builds one of the flimsiest of all nests, a framework of little twigs often placed quite low down in a bush or small tree, and sometimes so thin that you can see the eggs from below. It is brown above, pinkish grey below, with black markings on the neck, and it is a smaller, daintier bird than any of the other British species.

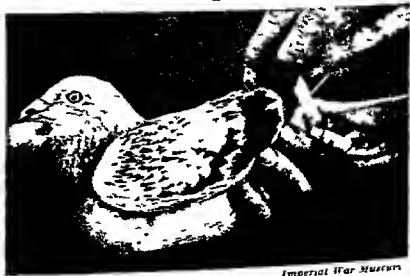
In all, more than 650 kinds of pigeons are known, including the fruit pigeons, so called because of their diet. They can swallow large fruits whole with ease. These birds have much more richly coloured plumage than the European pigeons.

Domestic pigeons are divided into four principal groups. The pouters are a very distinct race, having a gullet and crop that can be enormously inflated. A second group includes the carriers, which have long-pointed beaks, runts, which are large with long massive beaks, and barbs, with short broad beaks. Another group includes the fan-tails, turbits, tumblers, jacobins, and frill backs. Finally, there are those that more nearly resemble the rock-dove, such as the trumpeters with their peculiar note. Young pigeons are called "squabs," and these

are often fattened especially for "squab pie."

The homing pigeons are by far the most remarkable of the domestic species. These birds possess an astonishing sense of direction, and they are easily trained to fly home several hundred miles.

Typical speeds recorded for a homing pigeon are 72 miles in 2½ hours, and 180 miles in 4½ hours, or 40 miles an hour. They were used by the ancient Greeks and Romans, and during the siege of Paris in 1870-71. During the World War, these feathered messengers won the praise and



'CARRIER' IN THE WAR ZONE

All sorts of homing pigeons can be used as carriers. This one, whose two-barred wings show that it is a typical homer, has just delivered the message which is being taken from the little box attached to its leg.

admiration of the world. All the contending armies made use of them.

Pike. As you are walking along the shores of some shallow pond, or by the banks of a stream, you may see the surface of the water broken suddenly by a shoal of tiny fishes, which seem to be hurrying themselves into the air in an effort to escape from something. And so, indeed, they are, for they are being pursued by the terrible pike (*Esox lucius*).

If you approach the water quietly, you may see in a clear chalk stream, where the bottom is easily visible, the pike himself, for there is nothing he likes better than to lie absolutely motionless, half hidden beneath some weeds or behind a submerged log, waiting an opportunity to dart among the smaller fry and take a meal.

This is easy for him, for he has very large jaws, lined with rows of the most dangerous teeth, quite capable of killing a fish of his own size.

You can distinguish the pike, when you do see him—and often this is difficult, for he is pale green in colour and closely resembles the weeds and river bed—by the fact that his dorsal fin is set a long way back towards his tail, while his jaws are long and project forwards like a snout.

The pike is fished for in various ways. You may use a "live-bait," a small fish arranged on a series of books so that, while it is held tight, it



THE VORACIOUS PIKE

Dr A H Jacob

Even to us this looks a horribly greedy, fierce inhabitant of the stream or pond and you can imagine how the minnows and other small fish do their best to keep out of his way. One can distinguish the pike easily by his dorsal fin which, as you see, is placed right back towards the tail.

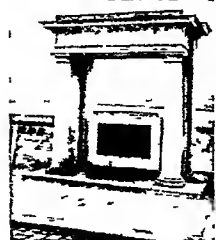
is free to swim to and fro, its position is marked by a big, round float, which you look at from time to time to see if there is a "bite." Another way is by spinning, either walking along the bank or being rowed in a boat, with a brilliant metal spinner or artificial minnow or other small fish. And, thirdly, there is trolling, similar to spinning but with a dead fish used instead of an artificial spinner. Pike run up to a good size in England, and are even larger in the Irish lakes. But a fish of 30 pounds is as large as you can ever hope to see. (See also Fishing)

PIONEERS of LIBERTY in AMERICA

Great adventurers were the Pilgrim Fathers, the brave band of seekers after freedom who crossed the Atlantic for a place where they might worship as they wished. On their principles American freedom still rests.

Pilgrim Fathers. When the Mayflower dropped anchor in the harbour of Plymouth on the coast of North America, in

December, 1620, and the weary storm-tossed Pilgrims stepped upon that shore (see Mayflower), they rejoiced that their long and arduous voyage was over. But the worst of their trials and hardships were yet to come, and more than half of the little band died during that first year of indescribable sufferings.



Pilgrim Fathers' Memorial on Plymouth Barbican

Their place of settlement was named Plymouth after the port in England from which the Pilgrim Fathers had embarked. So here it was that the historic landing of the Pilgrims was

first made, on December 21, 1620. A granite canopy now covers the rock—"Plymouth Rock"—on which they are said to have stepped off their boats. It was not until a week later that the rest of the party, including the women and children, set foot on shore.

Early Hardships of the Pilgrims

The cruel New England winter was already upon them, and the whole country, as one of their number wrote, "was full of woods and thickets, and presented a wild and savage hue." At once they set about felling trees and building log huts for shelter. The labour was exhausting and they suffered intensely from exposure. After the Mayflower departed for home food was scanty and consisted mostly of fish. A dreadful pestilence came upon them and wrought such havoc that at one time there were only about six or seven persons out of the whole number who were well enough to care for the others.

Least the Indians should learn how greatly their numbers were reduced, the bodies of those

who died (who included their first Governor, John Carver) were buried at night, and in the spring crops were planted over the graves. Fortunately the settlers were able to win the friendship of some of the Indian leaders, and a treaty of peace was signed. This was never broken on either side so long as any of the signatories lived.

The friendly Indians also taught them how to plant Indian corn, and next year's harvest banished famine and want from the settlement.

In ten years the result of the brave venture of this little band of freedom-seekers in the New World had proved not only a great moral victory, but an economic success as well. They had paid all their debts and proved that it was possible for a small body of earnest men and women to maintain themselves independently in the New World. Thus they paved the way for further colonization, and laid the foundation of the new nation.

A Daughter of the Pilgrims

SIX-YEAR-OLD Faithful was knitting a stocking. Her home was a pretty stone cottage with a thick roof of straw, in a quiet old English village. Roses grew round the open door, through which she could see the square grey tower of a stone church covered with ivy. The bell in the tower rang sweet chimes. The church had pointed windows of many-coloured glass. Between the cottages were thick green hedges. A mill stood beside a dancing river, and the mill-wheel churned the water to foam.

How Faithful Lived in England

Little Faithful's home was as pretty as a fairy bow, but her father often talked of going away to the New World of America to live. They were safe and comfortable in England, but they were not happy. They dressed and lived more soberly than their neighbours. They did not like going to the King's stone church, but wished to hold meetings of their own kind, where the sermons were preached by plain "lay" preachers instead of by surpliced clergymen. For this they were punished, for it was against the law to attend any services except those of the Church of England. Unkind people mocked them, and called them Puritans, but they were proud of that name, because they were trying to "purify" their religion.

Faithful wore a long plain gown of dark wool. A square of white lawn was folded round her neck. On her head was a stiff white linen cap almost like a sun-bonnet. Her face was rosy and dimpled, her loving eyes as blue as violets. Her yellow hair just *would* curl, and that was a trouble, for a little Puritan girl had to keep her hair smooth. She wore a white apron, with a pocket to hold her thimble and thread. The Puritans thought it wicked for even a little girl to be idle. Her brother Myles wore a wide-brimmed pointed hat, knee-breeches, a tightly buttoned coat, and a wide, square-cornered white linen collar.

One day their father said they must all get ready to go to America. Other Puritan families, who had for some years lived in exile in Holland, were going with them in a sailing vessel. They had to take nearly everything with them, for they could not buy even a needle in the wilds of

America. They packed big chests with clothing and blankets and feather-beds and table linen. Cooking pots and pewter dishes and candle sticks were put into barrels and boxes. The mother did not forget the spinning-wheel and loom for weaving. The father thought of tools and seeds and guns and knives and fishing nets.

The "Pilgrims" stood on this deck of the Mayflower and said good-bye to the green shores of England. Every one of the company could do something useful. There were carpenters and shoemakers and blacksmiths and farmers. There was even a soldier among them to lead them if they had to fight the Indians. Puritan mothers could do nearly everything to make people comfortable. The little girls could knit and sew and mind the baby. The smallest boy could make wooden shoe-pegs.

The Perilous Voyage to the New World

It was a long journey, in cold winter weather, over the ocean. Today we cross in great liners in less than a week. But the Pilgrims went over 300 years ago in a little sailing vessel, and the voyage took more than three months. Great waves beat the sides of the ship and rolled almost over it. The snow fell thick, and ice covered the deck. Fogs shut them in so that they could not see where they were going. Icebergs like white mountains floated in the water. They saw whales and, later on, seagulls. They wore near land.

The country where they landed was not green and pleasant like England. All they saw was black rocks and bare forests and soon fields of snow were everywhere. Of course, there were no houses for them to live in, so first of all the men had to chop down trees in the forest and build warm log houses, with chimneys of clay and sticks. Doors of axe-hewn boards were hung on wooden hinges. Thick oiled paper covered the small openings left for windows, but there was plenty of light from the big log fire. The straightest logs were split and laid for floors. The carpenters made tables and stools and bedsteads. The blacksmiths fixed long iron bars in the chimneys to hang cooking pots on over the fire. Everything was carried from the ship into the houses. Then the Mayflower sailed away home. The little pale-faces were alone in the

THE PILGRIMS FIND BASKETS OF INDIAN CORN



In the middle of their first winter with food scarce in the little settlement and no prospect of help from England until spring, the men explored the neighbourhood and in some heaps of sand found baskets of maize (Indian corn) which the Indians had stored in this way for their winter needs. Maize was an unknown grain to the colonists, but they found it much to their liking, and in the spring some friendly Indians gave them more maize for seed, and showed them how to plant it.



FIRST PRAYER-MEETING OF THE PILGRIM FATHERS IN AMERICA

After a voyage lasting more than three months, on December 21, 1620, the party of Puritans known since as the Pilgrim Fathers stepped from the *Mayflower* on to the coast of what is now Massachusetts. Their landing place they called Plymouth, after the English town from which they had set sail. Above is a reproduction of the engraving by George Schwartz, showing them holding their first prayer-meeting in America, on Sunday, January 21, 1621.

wide, wide New World of America with the red children of the forest.

They had a great deal to show each other. The Indians brought maize and told the white people how to make appetizing dishes with it, and how to grow maize in that rocky soil by placing fish in the ground as fertilizer. They brought maple sugar, and in the early spring taught their white neighbours to make maple syrup. In the summer Faithful and his brother found wild grapes, plums, and crab-apples, strawberries, and blackberries. In autumn there were nuts of many kinds. They gathered bayberries to make sweet-smelling candles. The carpenters made boats to fish for cod, the children dug clams from the sand on the beach.

How cosy it was in the log home in the evening! Half a tree could be put in the fireplace. The children ate their supper from bowls of wood, but they had white linen cloths and napkins. They brought their manners and their prayers and their school books to America.

A woman taught them to read and write and spell, and do sums in one of the cabins. They learned their letters from a "hornbook," more like a slate than a book. The only book they had to read was the Bible, and Faithful read it

through three times before she was 12 years old. Besides all this, she helped her mother. She had to learn to sweep a room clean with an Indian broom of birch twigs and to brush the hearth with a turkey wing. She made strong, brown, soft soap by boiling together lye water, strained through wood ashes, and fat.

Her brother went into the woods with his father to cut down trees. The forest land had to be cleared for fields, to grow maize and wheat and flax. Around every cabin was a little garden to grow peas, cabbages, and flowers. Oh, how the children watched the first green sprouts come up! And how they clapped their hands when they saw the first English daisy or rose! These made America seem more like a home.

In the fields and woods were violets and buttercups, as in England. One tiny, sweet-smelling flower in the pine woods that pushed its pink waxy clusters and glossy leaves right through the snow was strange to them. This is now known as the trailing arbutus, but they called it the "mayflower." Once in many months a sailing vessel came and brought them things from England. When it sailed away it took the furs of bears, beavers, and foxes to sell in London.

As the years passed, other Puritans settled in New England, some at Salem, others at Boston, and others elsewhere. Sometimes the Puritans and the Indians had fierce battles. The red man wanted the forests for hunting, and the white man wanted the land for farms and towns. Every settlement of white people had one big cabin that was both a meeting-house and a fort. The men carried their guns and powder-horns to church with them. They carried them, also, when they went to the fields to plough and to reap the crops they had sown.

Sometimes they built high walls of sharp pointed stakes round their villages. After many years the Indians went deeper into the woods and left the country near the sea to the white people. The Puritans learned to love their home in New England, where they could worship according to their own consciences, and rarely did any of them think of going back to Old England.

Other English people who were different from the Puritans arrived in America. But Faithful and Myles never saw the English children who lived in great houses by the wide rivers of Virginia. America was so big that the towns were hundreds of miles apart. Little Dutch children went to America to live, too, and French children and Spanish children, but they all lived so far from each other that they could not pay visits.

Pilgrims. In the Middle Ages men and sometimes women often travelled long distances as pilgrims in order to visit spots made holy by their connexion with the Christian religion. The tomb of St Thomas Becket at Canterbury, in England, and that of St James at Compostella, in Spain, were important objects of pilgrimage, but the most renowned were the shrines of the apostles Peter and Paul in Rome, and the holy places of Palestine, connected with Christ's life on earth. Hope of healing for diseased bodies or souls, a love of adventure, and the desire to see new lands all sped the pilgrims.

Pilgrims were under the special protection of the Church. The marks of a pilgrim consisted of the broad-brimmed pilgrim's hat—usually adorned on the return with sea-shells and leaden medals of the saint—together with a staff, sack, and cup for drinking. Wealthier pilgrims rode on horseback, and often travelled in considerable companies, as described in Chaucer's "Canterbury Tales" (See Chaucer). The humbler sort travelled on foot. They lodged in monasteries or in separate "hostels" established for their aid, especially on the great Alpine passes, in the chief cities of Italy, and in Jerusalem. Pilgrims returning from Palestine usually carried palm leaves, and hence were called "palmer's".

Books were written as guides for the pilgrims, directing them as to their routes, and telling, for example, how much they should pay for their seapassage from Venice to the Holy Land, and of the preparations for the voyage. They must take with them a feather-bed, with pillows, sheets, and blankets, and they must take provisions for their private use, as well as necessary medicines. When they landed they must beware alike of foreign fruits and robbers. A list of

phrases in foreign tongues was usually given, so that the pilgrim might ask his way and purchase necessary things. The stopping by the Seljuk Turks of pilgrimages to the Holy Land was one cause of the Crusades (See also Mayflower, Pilgrim Fathers).

Pin. A pin costs so little that we scarcely think it worth while to waste time picking one up, yet pins were once so expensive that only the rich could afford them. The change has come about through the invention of machinery which can turn out pins in such enormous quantities that the cost of manufacture is only slightly greater than that of the brass wire from which they are made.

The common pin is made of brass wire coated with tin. From the time the wire is fed into the



RELIC OF A 'PILGRIM' CUSTOM

The wearing of a scallop shell was formerly the mark of a pilgrim. On St James's Day shell grottoes were set up, at which those who could not make a pilgrimage presented offerings. Above we see one of the grottoes which are still made by children on this day—a survival of the old custom.

machine until the pins are stuck into the paper strips, ready for packing, the action is automatic. The wire is cut into proper lengths, the heads are formed by a die, and the points ground—all without the touch of human hands. Then the pins are dipped in acid to clean them, and receive a bright coat of metal by immersion in a solution of tin. Pushed along slowly until they have hardened, they drop into a revolving barrel of bran which cools and polishes them. They are then fed into a hopper with a steel plate at the bottom cut into slots just big enough to allow the body, but not the heads, of the pins to fall down in them.

Thus straightened out in rows, they move towards the edge and slide down an inclined plane. At the bottom of the inclined plane are strips of paper, in which the pins are caught and inserted. The mechanism is so delicate that the least imperfection in one of the pins will stop the feeding until the obstruction is removed. One of these machines will stick 100,000 pins an hour. Hairpins, safety-pins, and other kinds of pins are manufactured with similar machinery.

Pine. Of all forest trees the pines are among the most beautiful, the most numerous as to species, the most widely distributed and the most useful to mankind. They are practically confined to the Northern Hemisphere, and are common alike in Asia, Europe, and America. In size they range from a few feet in height to majestic species towering to 230 feet or more. They frequently form extensive forests, sparsely mixed with other well-known trees.

The pines are readily distinguished from the spruces, firs, larches, and cedars by their foliage and cones. The leaves of the pine, which are evergreen, needle-shaped and from a little more than an inch to more than a foot in length, usually grow in clusters of two to five, according to species, sheathed at the base by thin chaff-like scales. The leaves of the firs are simple, and grow in rows on opposite sides of the branches, while the cones are erect. Pine cones are pendulous, and are peculiar in the thickening of their persistent woody scales into a more or less pyramidal elevation at the top, with a

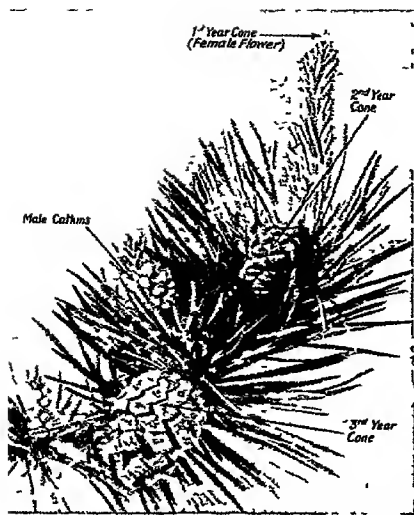
boss in the centre which is often hooked.

The only pine native to Britain, and our commonest species, is the Scots pine (*Pinus sylvestris*), which grows everywhere on heathy country, especially with birch trees, but is native only in certain districts in Scotland. This is also the most widely distributed of European species, being very common in the northern regions generally, it is one of the world's most important timber trees, and is equally valuable for indoor and outdoor work. It is very durable, strong, and tough, and has been extensively used in ship building. In older trees, growing in the open, the head tends to spread and become mushroom-shaped, while the branches are twisted and spreading. But in the forest this tree is as straight and pole-like as any, reaching perhaps 100 to 120 feet in height.



SCOTS PINE, OUR MOST IMPORTANT CONIFER

These Scots pines, growing on the outskirts of a wood, show you all the distinctive features of this important tree in about middle age. The trunk is tall, straight, and gradually tapering, while the bark is furrowed into long, scaly plates. The lower branches die off young, while the upper ones spread horizontally, terminating in tufts of the needle-like foliage. Examples like these make excellent and valuable timber.



FLOWERS AND FRUIT OF THE PINE

Here are shown the male flowers and the cones (fruits) of the Scots pine. The first-year cones are the fertilized female flowers and are red but those of the second year are green while in the third they are grey and open to shed the seeds.

Other important European species of pine are the Austrian and Corsican, each a variety of one species (*P. aricio*), both have been planted to a wide extent in Britain, especially near the sea. The cluster pine or pinaster (*P. pinaster*), also grown in Britain as an ornamental tree, covers vast areas in France near Bordeaux—actually the world's largest Man-made forest—where it is used to keep the shifting sands at bay, this pine is also the principal source of natural turpentine. The stone pine, a rugged, dark tree with huge squarish cones, is a native of Italy, where the big seeds are eaten.

The chief Asiatic pine is the Bhotan or Himalayan blue pine (*P. excelsa*), a slender tree, with long branches and rather dehcate needles which grow in fives. The cones are long and narrow, with thinner scales than those of the species to which we are accustomed. This tree is often planted in the south of England, particularly near London, as an ornamental species.

Numerous species go to form the great forests of North America, of

which the most important is probably the eastern white pine, or Weymouth pine (*P. strobus*). At one time this tree grew in great forests whose average height exceeded 200 feet, while individuals were 50 feet higher still. But these were rashly exploited and the finest trees all felled, often with much waste. This is a member of the pines whose needles are in threes, while the cones are like those of the Bhotan pine. The Weymouth pine, though still a most valuable timber tree in America, has not been a success in England. Even larger than this is the sugar pine (*P. lambertiana*), which may exceed 230 feet in height. Other North American pines are the Georgia pitch pine (*P. palustris*) or yellow pine of the southern states, and the tremendous yellow pine of the Pacific coast (*P. ponderosa*), which occasionally reaches a height of 200 feet. The soft, straight grained, resinous, and durable wood of the pines has placed them among the most valuable of timber trees, and they are also rich in turpentine, resin, and tar.

Pine-apple. A formidable array of stiff, prickly edged, sword-pointed leaves stand out in all directions on the rosette shaped pine apple plant and form the natural protection for the single fruit borne at the top of the main stalk.

The pine-apple (*Ananas sativus*) is a native of tropical America, but it is now grown in most tropical and semi tropical countries. The large fully ripe pine apple cannot be enjoyed in the distant market, however, for the fruit is picked



PINE APPLES BY THE THOUSAND

Pine-apples are among the cheapest of imported fruits and from this picture it is easy to see why. For a single plantation may cover many square miles, like this one in Honolulu, and with native labour the raising of the crop is cheap. These pines are just ripe, you can see plainly their familiar shape.

PINE-APPLE

before it is ripe and grows mellow during transportation. Our supply of the fruit comes chiefly from the West Indies, the Azores, and the Canary Islands. In recent years its cultivation has extended to other countries. Like most exotic fruits, it is cheaper and more easily obtainable tinned.

Pine-apples need little cultivation and do not require a rich soil. Each plant bears one fruit for the first crop, and later crops, which grow from sprouts (called "ratoons") on the stem below ground, generally yield two smaller fruits. When the fruit is ripe the pickers protect themselves against the prickly leaves with thick gloves and leggings, and out the fruits one by one with heavy knives. Cultivated pine-apples rarely produce seed. What we call the fruit is really the fleshy flower stalk. Parts of the individual flowers can be distin-



GARDEN PINKS

The pinks are among the favourite flowers of the garden, for their scent is as attractive as their appearance. Those shown here are of the double type, which at their finest approach the carnations.

PIPITS

guished by careful examination of the scales on this hard brown rind. The plants are usually grown from cuttings. These may be "slips," which grow in clusters near the base or near the top of the fruit, "suckers," which develop in the axils, or pookets, of the leaves, or "crowns," the leafy tufts at the top of this fruit. The plants bear for from eight to ten years without resetting.

Pink. Much of the spicy fragrance that hovers round gardens comes from the pretty fringed-petalled flowers called pinks. These flowers, which belong to the genus *Dianthus* of the order *Caryophyllaceae*, are natives chiefly of central and southern Europe and of the temperate parts of Asia. A few species are found wild in Britain, such as the Cheddar pink, and from some of these, which have become more or less naturalized, come the pinks and carnations of our gardens. Pinks are very old favourites, having been grown in English gardens for over 300 years. In course of time many large, beautiful, and fragrant varieties have been produced.

Pinks in the Countryside

The olove pink, the ancestor of the carnation, is supposed to have been brought to Britain by the Normans. In Normandy it is found growing on old castles, and in this country it grows in the same sort of places. Our commonest wild species, however, is the maiden pink, which grows in dry fields and banks. It has pink flowers and narrow, opposite leaves.

Pinks like good rich soil. The usual way of increasing them is by taking cuttings, or pipings, as they are called. These should be planted in soil which has plenty of sand mixed with it, and not in the sun. (See also Carnation)

Pipits. If you live in a moorland district, or anywhere where there are wide expanses of open country, you will know a little bird which looks at first sight very like a skylark, but which never seems to sing in the same way. This is the meadow-pipit, or titlark. In appearance it is, indeed, very like a lark, although its build is somewhat different, for this lark has a short, blunt beak and thickish figure, well adapted to seed-eating habits. The pipit, however, belongs to the same group as the wagtails (q v), and, being mainly an insect eater, has a



MEADOW-PIPIT AND YOUNG CUCKOO

The meadow-pipit is one of the birds most frequently parasitized by the cuckoo, and here you see one of these birds with its larger foster-child. The slender bill, long tail, and general build are characteristic of the whole pipit tribe.

longer, thinner bill, while it is also a slim bird. It has the longish tail typical of its group, and is a dullish, mottled brown in colour. Its nest, like that of the lark, is made of bits of grass, and placed in a hollow on the ground, it is often concealed by an exceptionally tall tuft of grass or a stone. The eggs are brown with dark mottling at the larger end, and usually four or five in number.

Another very common pipit is the rock-pipit, also a brownish little bird, which you see all round our sea coasts, running or flying nervously in front of you while you walk along the shore or the rocks at the base of the cliffs. It nests on the cliffs or in a niche of the rocks, and is perhaps our commonest shore bird.

A third species is the tree pipit, which is much more boldly marked than either of the other two, and looks somewhat like a miniature thrush on account of the dark markings on its pale throat and breast. It has a very sweet little song, and is often heard in the more open woodlands. Suddenly its song is interrupted as the little bird hurls itself into the air after an insect, but on returning again to its perch the pipit gives vent to another snatch of song. In other habits it is like the first two members of the family.

PIRATES AND PIRACY. Stories of pirates and buried treasure, of the "Jolly Roger," the black flag with the skull and cross bones, of captains and crews "walking the plank," while the cut-throats of the Spanish Main sang terrible deep sea songs to the tune of waving cutlasses—such tales have been read and re-read by English children for generations. They usually end with the pirate chief hanging at the end of a ship's yard arm, after his black hand has been sent to "Davy Jones's locker" in a hot fight with a man o'-war.

In these tales—among the best of which is R. L. Stevenson's "Treasure Island"—there is at once more and less than the truth. When history's microscope is focused on the pirate, he usually turns out to be a dismal villain without a trace of romance. He played on the high seas the same part that the "boss" of a gang of thieves and murderers plays on land. On the other hand, pirates were by no means always punished or even discouraged in their lawless employment. Men of position and wealth at times provided them with ships and equipment in return for a share of the booty. Even governments sometimes gave secret support to adventurers whom we should regard as pirates, provided they attacked only enemy or neutral vessels.

Piracy has existed since the earliest days of seafaring. From the times that are described in Homer's *Odyssey* the ocean has ever been looked upon by lawless men as a sort of watery

"no man's land." In the earlier days piracy was almost respectable, but when the great nations of Europe began to depend on their foreign commerce, international law declared it a crime against all mankind.

Death was the usual penalty when caught, but, despite severe measures to repress them, pirates continued to flourish so long as they could find a place of refuge and a market for their stolen goods. The last great den of pirates on the Barbary coast of northern Africa was attacked in 1815, and their power broken. These Barbary corsairs, as they were called, had been protected for centuries by the native rulers of those wild shores. Organized piracy today has been wiped out everywhere except on the coast and rivers of China, where pirate hands in sailing junks still plunder small craft when opportunity offers.

Some Famous British Pirates

Among the best-known pirates, besides Captain Kidd and Sir Henry Morgan (qv), was Captain Avery, who flourished in the late 17th century. His adventures are said to have inspired Defoe's "Life, Adventures, and Piracies of Captain Singleton." Another famous free hooter was Bartholomew Roberts, the nearest approach in history to the pirate of romance, being brave and often generous. He was killed in battle off the coast of Africa in 1722.

A sharp distinction must be drawn between pirate ships and "privateers." The former were never officially recognized by any civilized country, but the latter (among the captains of which was Sir Francis Drake) were for many years regarded as a legitimate part of the sea forces of the great nations. Their duty was to attack the merchant ships or even the war vessels of the enemy. They received their reward in the vessels and merchandise they captured. Privateering was abolished in Europe in 1856 by the Declaration of Paris.

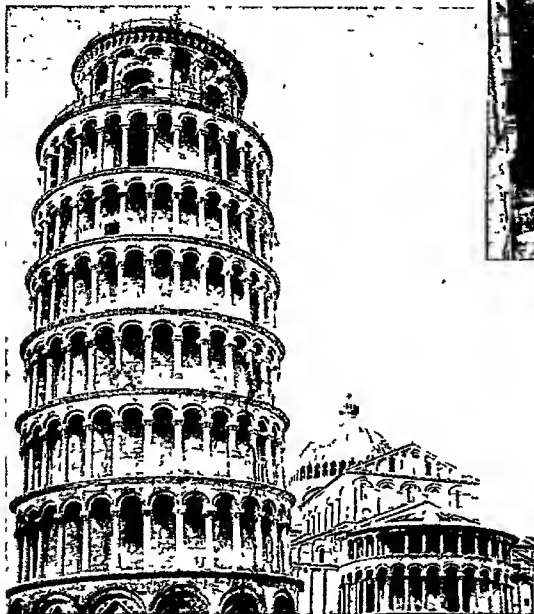
Pisa, (Pron pe'-za), ITALY. The "leaning tower" of Pisa has done much to make this city on the Arno famous. Constructed entirely of white marble, with walls 13 feet thick at the base, the tower rises eight storeys and 179 feet. At the top it is 16½ feet out of the perpendicular, in other words, a stone dropped from the lower side of the upper gallery would strike the ground 16½ feet from the wall at the bottom of the tower.

A stairway of 300 steps built in the walls leads to the top, where a magnificent view of the city and of the sea, six miles away, is unfolded. The tower, intended as a bell-tower for the cathedral, was begun in 1174 and finished in 1350. The foundations were laid in sand, and it started to lean after the first three galleries had been built, but the work went on with slightly changed plans. The scientist Galileo, who was born in Pisa, used the tower in his experiments for

PISA

determining the velocity of falling bodies. In the same square as the tower are the Pisa cathedral and baptistery, which, like the tower, are fine examples of Romanesque architecture, and the ancient city walls and citadel add interest to a tour of the city.

Rehearsals of the days when Pisa was a Roman colony are preserved, but the city did not gain great historical importance until the depredations of the Saracens in the 11th century. The inhabitants not only drove out these foes, but pursued them to Sicily and even to the shores of Africa. For some time afterwards Pisa figured



as a powerful and wealthy maritime city republic. It took an active part in the wars and politics of Italy for four centuries.

Pisa's decline began with a defeat of the Pisan fleet by the Genoese in a great sea fight off Meloria (near Leghorn) in 1284. It was conquered by Florence in 1406, and thenceforth held in subjection by that state except for the brief period 1494-1509. As a part of the grand duchy of Tuscany, it was absorbed into the rising kingdom of Italy in 1859.

Commercially the town today has little importance. Cotton manufacture is the chief industry. It has a university, founded in 1338,

PITCHER PLANTS



PISA'S LEANING TOWER

From the famous leaning tower of Pisa (left) Galileo made his experiments in the laws of gravity (see page 1934). The photograph above, taken from one of the galleries of the tower looking towards the cathedral, shows how the tower leans from the vertical.

Courtesy of E. V. I. T.

still an important centre of learning. The population is about 72,000.

Pitcher-plants. Some plants have turned insect-catchers in order to supply themselves with nitrogenous food. The pitcher-plant is the most noted of these. Many species have been found in tropical Asia and Borneo. They are climbers, pulling themselves up over shrubs by tendrils formed by the midrib of the leaf extending beyond the tip. On many of these tendrils are developed wonderful little pitchers standing upright, with lids that stand outnighly open.

Each pitcher is a trap. It has a stout sleek rim, which is curved inwards and contains glands that give forth a sweet juice, attractive to insects. Below the rim the inside of the pitcher is very smooth, so that visiting insects falling over the rim slide down in spite of their efforts.

In the lower part of the pitcher are glands that secrete digestive fluid, which partially fills the pitcher. The rim and the cover of the pitcher are blotched with red, to attract the insects which come eagerly to sip the sweets. These possibly act as intoxicants, since many usually wary insects fall into the fluid and are digested, for the plant literally eats them.

Most pitcher plants belong to the genus *Sepentes*, of which there are about sixty species. The swamp loving pitcher-plants of America, often called side saddle plants, form the genus *Sarracenia*, comprising about seven species. (See Plant Life)

Pitt, William (1759-1806) "It's not a chip of the old block, it is the old block itself," enthusiastically exclaimed the orator and statesman Edmund Burke, after listening to the first speech in Parliament of William Pitt "the Younger," the second son of the great Earl of Chatham (q.v.) This praise was given to a young man only 21 years old. But William Pitt had "an old head on young shoulders." Indeed his friends said that he had never been a boy.

He was born when his father's power was at its height, but along with that inherited father's abilities he inherited also his ill health. As a result he was such a delicate sickly boy that he was never sent to the great public schools, as were his brothers, but was taught at home by private tutors until he entered Cambridge University at 11.

Every night at home his father would make him read Greek and Latin authors aloud, and to this practice were attributed his extraordinary readiness and fluency of speech.

William Pitt lived for politics. His chief amusement was to go to Westminster to hear his father speak. When his father was created Earl of Chatham, he is reported to have said: "I'm glad I'm not the oldest son, for I want to speak in the House of Commons as papa did." This wish was granted at the age of 21. At 23 he was Chancellor of the Exchequer, and at 24 he was Prime Minister of Great Britain—the youngest man who ever held that great office. For nearly a score of years, in one of the most trying times in history, he directed the affairs of his country.

During his first years in office Pitt reformed the finances of the kingdom and attempted to bring about other reforms. But before he could accomplish much the French Revolution broke out, and the time for internal reforms was past. Pitt kept England neutral as long as he could, but the excesses of the revolutionists so outraged the feelings of the English that in 1793 peace became impossible.

For the rest of his life, except the three brief years (1801-04) when he was out of office because King George III would not support his measures to allay Irish discontent, Pitt had

to struggle with problems arising from the great war with revolutionary France. He not only had to keep a strong fleet on the seas and an army on land, but he had also to provide money for England's allies on the Continent.

At length the struggle proved too much for Pitt's frail body. Napoleon's victory at Austerlitz over England's allies, the Austrians and the Russians, proved Pitt's deathblow. Even the news of Nelson's great naval victory at Trafalgar, while it cheered him, could not postpone the end. He died on January 23, 1806, less than two months after Austerlitz. A short time before his death he exclaimed, "Roll up the map of Europe. It will not be needed for another ten years." And his last words on his death bed were: "Oh, my country! how I leave my country!"

Pittsburgh, USA Not unjustly we Pittsburgh's skies red by night and murky by day for it commands the Slaves of the Lamp—fire, the fuels that feed it, and the industries nourished by it. Here, where the rivers



WILLIAM PITT 'THE YOUNGER'

Pitt lived entirely for his country, and his wisdom and courage guided the fortunes of England safely through a period of danger. His great ambition was to be a peace minister, but he was destined to be England's war minister. This portrait of Pitt was painted by Sir Joshua Reynolds.

PITTSBURGH

Allegheny and Monongahela cleave the hills to meet and form the Ohio, is one of the most magnificent city sites in the world

First the rivers, then the fuels with which the region abounds—first transport, then power—made Pittsburgh a great city Young George Washington, who visited the place in 1753, saw the strategic importance of the site as the gateway to the West But the French built Fort Duquesne there the next year, and not until 1758 was this post reduced by the English and christened Fort Pitt, or Pittsburgh

Pittsburgh is a great manufacturing city because it is the focus of the largest and most productive coal-field on the continent and of a highly productive oil-field, and taps one of the richest gas-fields in the world A large proportion of all the coke manufactured in the United States and about 10 per cent of all the bituminous coal mined in the world come from the Pittsburgh district of Pennsylvania

The "Smoky City" is also the "Iron City" and the "City of Steel," for it makes annually more pig-iron and steel than any other city of the United States, and more steel rails, steel plates for shipbuilding, and pressed steel carriages than any other city in the world The structural steel industry originated here Pittsburgh insulated wire plays a large part in the electrical industry

All the metal industries, the production of both raw material and finished product, are of vast extent Pittsburgh leads the world in the

manufacture of plate-glass, window glass, pressed tableware, bottles and lamp chimneys, and produces a high grade of optical glass The largest cork factory in the world makes every kind of cork product, from bottle stoppers to life belts and floor coverings Chemicals (especially those derived from coal-tar), salt, fire brick, and fire-clay, electrical and other machinery, and water-pipes and plumbers' supplies are among the other Pittsburgh products

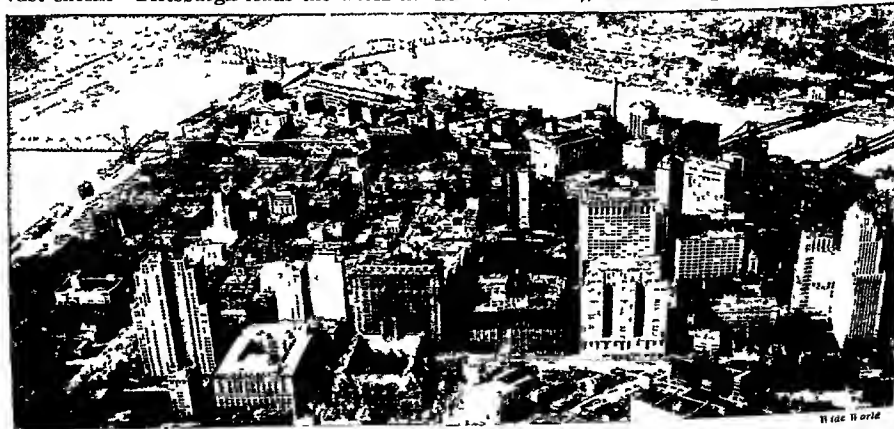
Pittsburgh has many fine public buildings, parks, and other places of interest, a great Institute of Technology established by the gift of Andrew Carnegie, and the University of Pittsburgh, dating from 1787 and now housed in a beautiful skyscraper known as the Cathedral of Learning The population is about 689,000

Pius. PORES Eleven Popes have borne this name The earliest, Pius I (Pope c 140 to 154), belonged to the period before Christianity was the established religion in the Roman Empire

Pius II (Pope 1458-1464) was a well known "humanist" scholar and writer of the Renaissance, named Aeneas Sylvius Piccolomini He was born near Siena and his letters and other literary works are important sources for the history of the time

Pius IV (Pope 1559-1565) and Pius V (Pope 1566-1572) were both active in furthering the work of the Council of Trent and in checking the spread of Protestantism

Pius VI (Pope 1775-1799) and Pius VII (Pope 1800-1823), both belonged to the period of



PITTSBURGH—A WORKSHOP OF THE WORLD

The second city of Pennsylvania, Pittsburgh lies at the confluence of the Monongahela and Allegheny rivers, which here unite to form the Ohio Above is an aerial view of the central business section of Pittsburgh, known as the "Golden Triangle." Pittsburgh is essentially an industrial city, and is the focus of many trunk railways It is often alluded to as the "Iron City," on account of its famous iron works A quarter of the entire output of pig-iron of the United States comes from Pittsburgh

PIUS

upheaval caused by the French Revolution and Napoleon Bonaparte

PIUS IX (b 1792, Pope 1846-1878) was, perhaps, the most memorable Pius because of his long pontificate—more than thirty years. His early liberalism in politics (until checked by Mazzini's attempt to establish a republic in Rome, in 1849) the stern reaction in the papal government which followed under Cardinal Antonelli and the loss of the temporal power of the Papacy, in 1870, when Rome was by force made the capital of the new kingdom of Italy. Pius IX thereupon established the policy by which the Pope confined himself to the Vatican Palace and its surroundings, and refused recognition to the Italian King. In 1854 Pius IX issued a bull establishing as a doctrine of the Church the dogma of the Immaculate Conception of the Virgin Mary. The Vatican Council, held by him in 1869-70, further proclaimed as a necessary part of the Catholic faith the doctrine of the Pope's infallibility, when acting officially, in matters of faith and morals.

PIUS X (b 1835, Pope 1903-1914) was of humble birth. He coming a priest he rose to be bishop of Mantua, was made a cardinal in 1893, and shortly after became Patriarch (archbishop) of Venice. During his pontificate were made the laws in France decreeing the complete separation of Church and State.

On the outbreak of the World War Pius X issued (August 19, 1914) an ineffectual appeal for peace, and his death at the age



POPE PIUS IX

One of the longest pontificates in history was that of Pope Pius IX, it lasted for thirty-two years, from 1846 to 1878. Amongst other things it is memorable because of his appointment of Catholic archbishops and bishops to sees in Britain after an interval of several centuries.

story of the conquest of Peru by an obscure adventurer forms one of the most dramatic episodes in the history of the New World. At the age of 50 Pizarro was a captain of infantry

of 79 is said to have been hastened by grief at the war.

PIZARRO

PIUS XI (born 1857) Ambrogio Achille Ratti was born near Milan, the son of the manager of a silk factory. He succeeded Pope Benedict XV on February 6, 1922, as Pius XI, and brought about the settlement of the vexed "Roman Question," resulting from the incorporation of the Papal States with Italy in 1870, by the Lateran Treaty of 1929. Italy recognized the Vatican City as an independent sovereignty. As spiritual ruler of a great part of the human race, he has enlisted the aid of wire-ess in sending out encyclicals (circular letters), Christian messages, and so on to his people. He became seriously ill in 1936.

Pizarro, FRANCISCO (about 1471-1541). The story of the conquest of Peru by an obscure adventurer forms one of the most dramatic episodes in the history of the New World. At the age of 50 Pizarro was a captain of infantry



PIZARRO SEIZING THE INCA OF PERU

A barbarous method of colonization, by which the inhabitants of a country were driven out, murdered, or enslaved by their conquerors was employed in the heyday of Spain's empire. Here is a reproduction of the painting by Sir John Millaes showing Francisco Pizarro seizing the Inca or supreme ruler of Peru and putting the natives of the country to the sword.

on the Isthmus of Panama, with nothing to show for years of toil and peril but a small holding of land. In little more than a decade he had conquered the fabulously wealthy empire of the Incas, and had bestowed on Spain the richest of her possessions in the Americas.

Violence and perfidy were the instruments with which he worked, and by violence and perfidy he came to his death. Resolute and daring to the last degree, he was infinitely greedy and merciless, and the sufferings of the peaceful natives of Peru at his hands are among the saddest chapters in history. In extenuation of Pizarro's crimes it must be remembered that his early days were cast in dark places. He was the illegitimate son of a Spanish colonel, and was left to grow up without care. To the end of his days he was never able to write his name, and tradition says that he spent his youth as a swineherd.

Some time before 1510 he sailed to seek his

fortune in the recently discovered New World. After accompanying Balboa on the journey that resulted in the sighting of the Pacific Ocean (1513) he became a cattle farmer. Then reports reached him of a vast and wealthy empire to the south. Pizarro's imagination was kindled, and he sought the aid of two friends in equipping an expedition for its conquest. His associates were another soldier

named Diego de Almagro and a priest named Hernando de Luque. This strange partnership was formed in 1522, and four years later on March 10, 1526, an actual contract was signed by the three adventurers for the conquest of Peru.

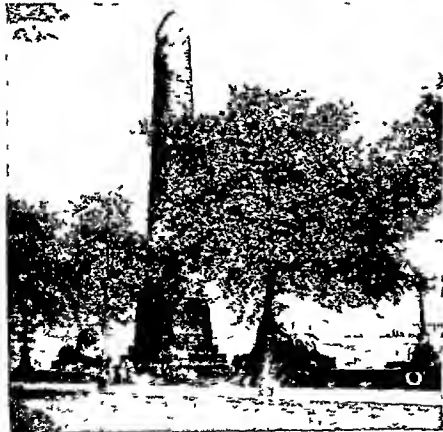
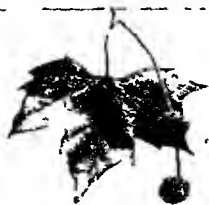
A first expedition resulted in disaster, after two years of suffering and hardship. A second expedition later fared little better. The adventurers found they were too few for the task, and Almagro was sent back to Panama for reinforcements, while Pizarro and part of the force remained on an island. But the governor of Panama was not inclined to support the enterprise.

Discouraged at the indifference of the governor, Pizarro returned and sailed to Spain, where he applied for authority to undertake the conquest of Peru. A commission was given him for his enterprise, and he sailed from Spain on January 19, 1530, and from Panama the following year, with three vessels, containing fewer than 200 men.

After seven years of hardship and disappointment the adventurers were now embarked on the actual conquest of Peru. After a year spent in the subjugation of the coast settlements, Pizarro marched inland to the city of Cajamarca, where he captured Atahualpa, the Inca emperor, by one of the treacherous acts for which he became notorious. Atahualpa offered, by way of ransom, to fill with gold a room 22 feet long and 17 feet wide to a point as high as a man could reach, and to fill it twice over with silver. Pizarro accepted this offer, received the precious metal, estimated at more than £3,000,000, and had Atahualpa killed.

Pizarro then marched to Cuzco, and set up the young Inca, Manco, as nominal sovereign. In 1535 he founded Lima, the present capital of Peru, as the centre of his new government. Two or three years later a fierce quarrel arose between Pizarro and Almagro concerning the territory each was to govern. This contest assumed the proportions of a civil war and resulted in the capture and execution of Almagro. Afterwards the embittered and discontented followers of Almagro conspired against Pizarro, and finally assassinated him on June 26, 1541. (See also Incas, Peru, South America.)

Plane. This tree has been famous for thousands of years, for even the ancient Persians, Greeks, and Romans used to admire the plane tree (*Platanus orientalis*), which reached a great age and size in their countries. In America the plane is called the sycamore, and in Scotland the sycamore is called the plane. You can tell the tree by this way it sheds its bark in sheets during the summer months, as well as by its distinctive leaves and fruits.



PLANE TREE AND ITS DETAILS

The London plane, a variety named after the city in which it flourishes so well, is easy to distinguish by the shape of its leaves and by its round balls of fruit shown in the small upper picture. The lower photo shows some of these trees growing on the Thames Embankment.

Photos top J. J. Hard bottom Fox Photos

CHILDREN of the SUN — *The Earth's Sister Planets*

Planets. Strictly speaking, planets are not "stars" at all. The planets belong to our solar system, of which the earth is one member, circling about the sun. They shine, not by their own light, but by the reflected light of the sun. It is because the planets each move at different rates of speed, and in orbits at varying distances from the sun, that they seem to "wander" through the sky. But they follow laws as unchangeable as those which govern the stars.

The major planets, in the order of their distance from the sun, are Mercury, Venus, the earth, Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto. They all revolve from west to east. Mercury and Venus are called the "inferior" planets, because they lie between the earth and the sun, while the outer planets—Mars, Jupiter, Saturn, Uranus, Neptune, and Pluto—are classified as "superior." The inferior planets move about the sun faster than the earth, while the superior planets move more slowly. In addition, there are several hundred small bodies called "asteroids" revolving about the sun between Mars and Jupiter. (See the article on Asteroids.)

LOOKING up at the heavens, night after night, we observe stars that seem to move about in a peculiar fashion, apparently not controlled by the same laws which rule the rest of the heavenly bodies. The Greeks thought their motions so unusual that they called these stars "wanderers" or "planets" and that is the name by which we know them today. They are sisters to our earth and children of the sun about which they revolve. If we picture the sun as a ball nine feet across, the earth—a 1-inch speck—would be 330 yards from the sun, and Pluto, the outermost of the planets 14,500 yards, the nearest fixed star would then be 40,000 miles away! This gives some idea of the unfathomable distances of cold lifeless space which separate our planetary system from the rest of the universe.

Sir Isaac Newton first proved that every planet is acted on by a force emanating from the sun, and he also proved that this force had a measurable relation to the distance of each planet from the sun.

We know that it takes the earth 24 hours to revolve once

on its axis, to complete a day, but the day on Mercury, Venus and Pluto is still unmeasured. A day on Mars is 24 hours, 37 minutes on Jupiter, 9 hours, 55 minutes, on Saturn, 10 hours, 14 minutes, on Uranus, 10 hours 45 minutes, on Neptune, 16 hours.

While all the planets belong to one family, they are by no means all alike. Some are smaller than the earth, and some are hundreds of times larger. Some are very hot, others are very cold. Some have scarcely any atmosphere (that is, what we call "air"), and some have little or no water.

Mercury is 36,000,000 miles distant from the sun. It has a diameter of 3,000 miles, less than half that of the earth, but its density is 0.61—that is, it is less than two thirds as heavy as the same volume of the earth. Its surface gravity is only thirty one hundredths that of the earth, which means that an object weighing

PLANETS

100 lb on this planet would weigh only 31 lb on Mercury. Finally, a year on Mercury is only 88 earth-days long.

Strong evidence has been brought forward to support the theory that animal and vegetable life of some sort exists on Venus and Mars.

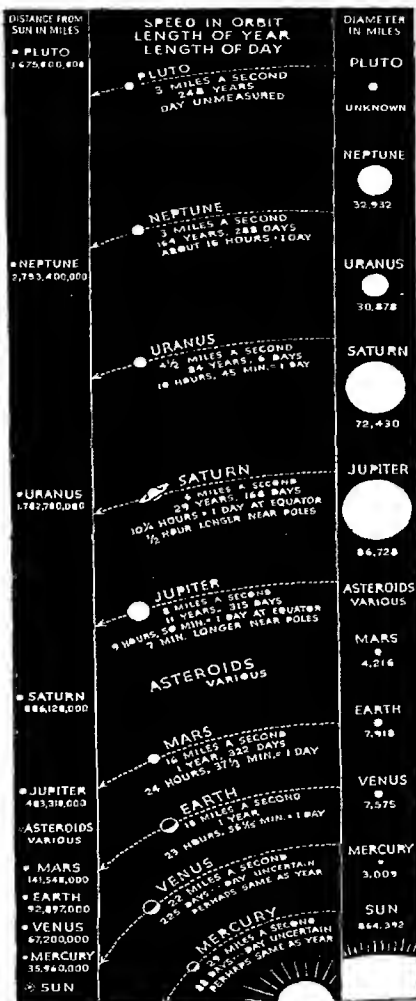
Professor Percival Lowell has become world-famous for his theory that Mars is inhabited by beings of a very high degree of intelligence, although they would not necessarily have the forms of human beings. He finds on that planet a vast network of canals, which he takes as proof that the inhabitants are not only highly intelligent, but that they are engaged in a life-and-death struggle against extinction from lack of water.

Whatever the truth, it is certain that life on Mars would be very strange and very different from what it is on earth. The planet is only about half the size of the earth, and an athlete who could jump 6 feet high on the earth could jump 16 feet on Mars, because the surface gravity is so much less. If he got on a pair of Martian scales he would probably doubt his senses, for if his ordinary weight was 11 stone, he would find that it had shrunk to about 4 stone. Summer and winter on Mars are nearly twice as long as they are here and the average temperature is probably below zero, though during the long summer it may rise above freezing-point. Seen from the earth, Mars has a reddish appearance, probably due to great desert areas.

Conditions on Venus are more nearly like those

on the earth. It is very nearly the twin of the earth in size, and it probably has the same kind of atmosphere. The great unsolved question about Venus is whether daylight and darkness succeed each other as they do on earth, or whether one-half of the planet is in perpetual daylight and the other half in perpetual darkness. In any event the heat must be intense, because of the comparative nearness to the sun. The other planets are not believed to be inhabited even by low forms of life, but they are no less interesting to the astronomer.

As viewed through the telescope, Saturn, with its wonderful rings, is one of the most curious and superb sights in the heavens. It entirely mystified the early astronomers, but today we know that these rings are not continuous masses of matter, but are composed of swarms of dust like meteors revolving about the planet. These three (perhaps only two) rings are of enormous circumference from the inner edge of the innermost to the outer edge of the outermost is a distance of 42,200 miles, or more than half the diameter of the planet itself. On the other hand, the rings are extremely thin, probably between 15 and 25 miles. About every 15 years Saturn's path brings it in such a position that its rings are presented edge ways to the earth. They are then found to be so thin that they can hardly be seen even through the most powerful telescope. Saturn is an enormous globe, equivalent to about 719 worlds like the earth rolled into one.



FACTS ABOUT THE PLANETS

This diagram shows how different the planets are in size, velocity, and the dimension of their orbits. Since distances from the sun vary in each planet's "year," the mean or average distances are given. The diameters are the mean of the polar and equatorial diameters. Rotation time is given in sidereal days, 366 to the year for the earth.

PLANETS

Jupiter is even larger than Saturn, it is the greatest of the planets. If Mercury, Venus, the earth, and Mars were placed edge to edge, they would represent only a little more than a quarter of Jupiter's diameter.

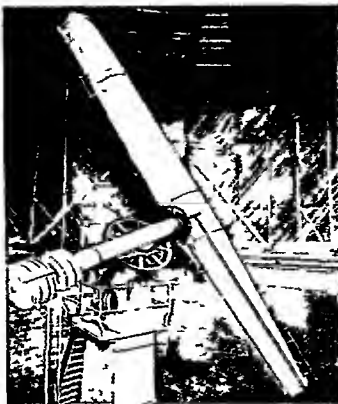
Through the telescope we see that Jupiter has a number of strange markings consisting of a series of dark and bright belts. Dark spots also appear from time to time, which gradually turn red and finally vanish. What we observe are probably clouds of vapour or gases thrown from internal fires.

It is probable that Jupiter is in an early stage of evolution. Looked at in this way, Mercury, the smallest of the planets and the one nearest the sun, is old, Mars is middle aged, and Jupiter is still comparatively young.

Uranus and Neptune, owing to their distant positions, were not discovered till after the invention of the telescope, and Neptune is never visible to the naked eye. Uranus was discovered by Sir William Herschel in 1781.

The discovery of Neptune was one of the brilliant achievements in astronomy. Observations of Uranus showed that its actual position varied slightly from the one which theory showed it ought to have. The suggestion was then made that these discrepancies might be the result of the attraction of an unknown planet. Adams and Leverrier independently calculated the position of the planet and Galle first observed it (1846). Almost similar circumstances marked the discovery in 1930 of Pluto, by Tombaugh. Its existence was predicted 15 years before by Lowell, who did not survive to make the discovery. Pluto is the most distant of the planets, being 3,680,000,000 miles from the sun. It travels at three miles a second and takes 248 years to complete its orbit. The size of the planet and the length of its day are unknown.

With the exception of Mercury, Venus, and possibly Pluto, all the planets have satellites (or moons) which circle about them just as our moon does about the earth. Mars has two, which are very small. Jupiter has eleven, Saturn, ten, Uranus, four and Neptune has one satellite.



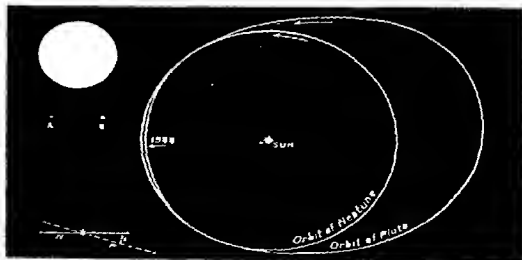
DISCOVERY OF PLUTO

This 24-inch telescope at the Lowell Observatory, Flagstaff, Arizona, was used to prove the existence of Pluto, 15 years after it had been predicted by Dr Percival Lowell.

At the close of the 18th century (1796) the French astronomer Laplace advanced what is known as the "nebular hypothesis" as a possible explanation of the way in which the planets were formed. All the matter which now makes up the solar system, he suggested, was once a vast glowing mass of hot vapour or gas, resembling one of the gigantic nebulae which we may still see through the telescope (See Nebulae). As it cooled and contracted, this mass began to rotate ever more and more rapidly, until a series of rings like those of Saturn were thrown off and left behind. These rings then condensed into the planets.

The earth itself, according to Laplace, was at first such a flaming mass of gaseous matter which slowly solidified, although it long remained very hot. The outer crust cooled, but the inner mass still retained a high temperature. Gases were thrown off to form an atmosphere, which in turn poured down water on the surface of the earth. Cooling and contraction of the interior caused the crust to wrinkle thus forming the mountains.

Today astronomers generally reject this hypothesis. Among many other things, it fails to explain why Phobos, one of the satellites of Mars, revolves three times round that planet, while Mars itself is rotating once. Nor does it explain why two of Jupiter's satellites revolve



THE ORBITS OF PLUTO AND NEPTUNE

This diagram shows how the paths of Pluto and Neptune overlap. If the circle (top left) represents the sun as seen from the earth, then A shows what size the sun would appear from Pluto when at its greatest distance from it, and B when at its nearest, which will next be in 1983. At the bottom left is shown the inclination (i) of the orbits of Neptune (N) and Pluto (P).

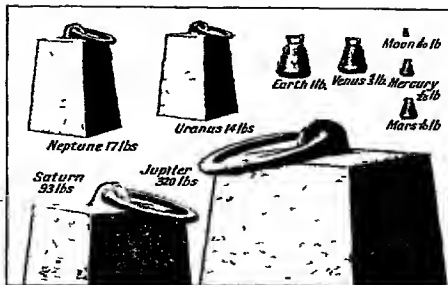
PLANETS

from east to west, while the other nine revolve from west to east.

Finally, if we are to accept the nebular hypothesis as correct, we should expect the outer planets, such as Neptune and Jupiter, to be older in development than the earth and the other inner planets, because, according to the theory, they were thrown off first. But the exact contrary seems to be true.

The best explanation reached thus far of the origin of the planets is the "planetesimal theory," which entirely discards the idea of ejected rings. This theory starts with a central mass, which eventually became the sun, and innumerable small bodies called "planetesimals," circling largely in one direction in one plane. In the course of their travels round the sun some of these planetesimals grew larger and larger by sweeping up all the material in their path, including the smaller planetesimals. Growth continued in this fashion until they became planets as they exist today.

Thus we conceive of the earth as having grown from a very small amount of matter to the great globe upon which we live. When it was much smaller it had no atmosphere and no internal heat. But as it grew it collected an atmosphere, and the great pressure of its increased weight caused the interior to become intensely hot. According to the planetesimal

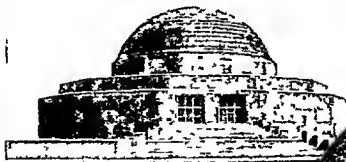


THE MASSES OF THE PLANETS

Taking the weight or mass of the earth as one pound, this drawing shows us the relative masses of the moon and seven of the other planets on the same basis. There is still much doubt as to the true mass of Pluto.

theory, the process of growth, so far as it relates to the solar system, is practically finished. Sir James Jeans modified this hypothesis and proposed the simpler "tidal theory." He suggests that another star approached the sun so closely that it pulled out of the sun a great cigar-shaped streamer of gas, which condensed like drops of steam to form the planets. (See Astronomy and the articles on the individual planets.)

A working scale model of the planets was first devised for the Earl of Orrey by Rowley in 1715. A more modern machine, originally designed by Zeiss of Jena in 1913, is called a "planetarium," and projects points of light representing the stars on to a fixed dome above the audience. Further projectors produce images of the planets that move through the constellations at their proper speeds. By speeding up the mechanism, a year may be compressed into seven seconds, so that the planets appear to be chasing one another in the sky. The instrument can be made to project the date of the phenomena on to the dome as well as the names of the constellations, and a luminous pointer enables the lecturer to point out objects in the "sky." Similar planetaria have been built in Germany and the U.S.A., where they are very popular.



Above is the Adler Planetarium and Astronomical Museum of Chicago, the first of its kind in America, and to the right, the auditorium with a lecture in progress. On the vaulted ceiling, with Chicago as seen from the Planetarium site silhouetted against the skyline, an intricate mechanism projects a realistic picture of the heavens, exactly duplicating the motions of the stars and planets through the ages. Note the lecturer's pointer, a beam of light

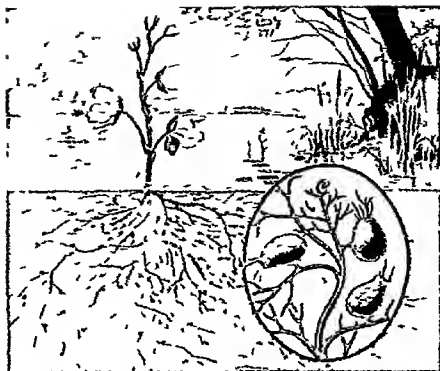


The Zeiss projector which demonstrates the drama of the sky

THE PLANETARIUM WHERE THE DRAMA OF THE SKIES IS STAGED

AN ENGLISH INSECT EATING PLANT—

ON the right you see the bladderwort shown as it grows at flowering time half in and half out of the water. The pale yellow flowers are all that are normally visible but on the thread-like, floating roots are borne the little bladders which are shown considerably enlarged in the inset. These have a trap door arrangement guarded by hairs, which allows tiny insects and other water animals to enter but prevents them escaping. Gradually after they have died the poisonous material is dissolved and their nutritious material is absorbed into the plant's tissues.

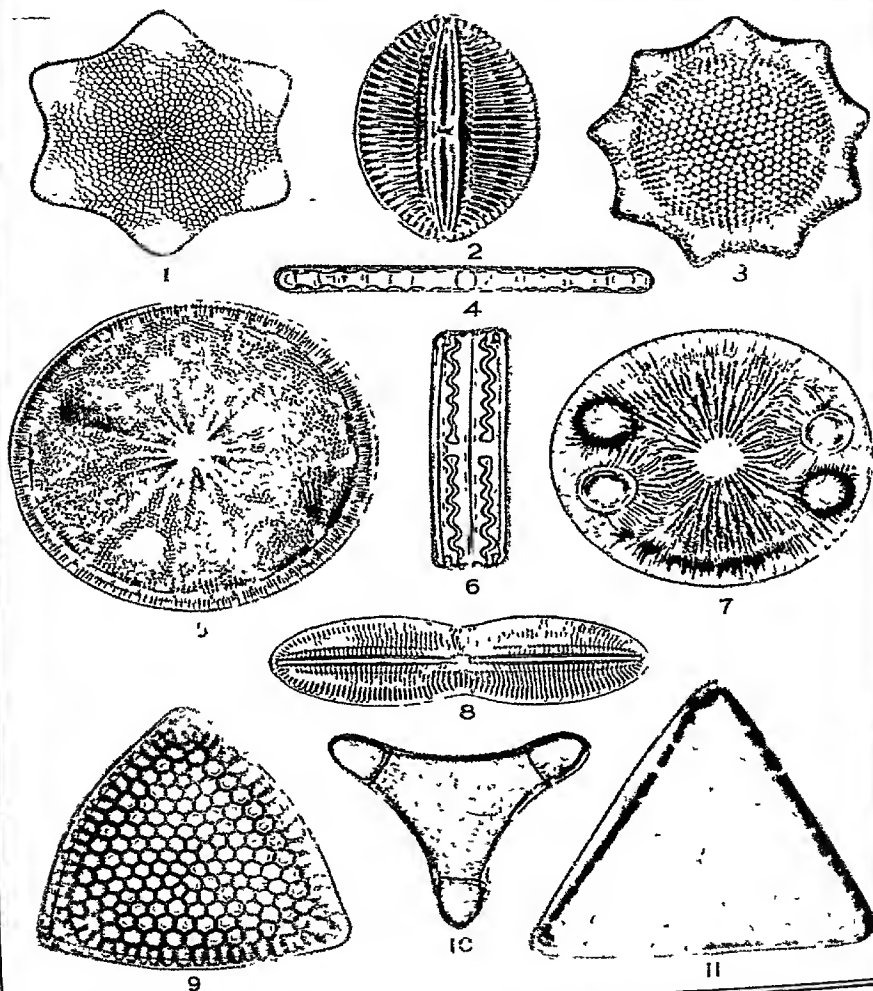


—AND ANOTHER FROM AMERICA

IN America there are numerous types of insectivorous plants, of which the pitcher plants (see page 3260) are among the most remarkable. On the left are a group of them, growing on a tree trunk, from which hang their long leaves whose tips form the 'pitchers'. The inset shows one of these in section with a number of flies and other insects inside. Having made their way in, attracted by the smell of the plant's sticky secretions they are incapable of escaping and eventually are digested to form part of the plant's animal diet. There are many species of these strange plants of various types, and they may be grown in England in a hot house.



DIATOMS—TINY PLANTS OF EXQUISITE DESIGN



Housed in glass-like cases, whose beauty of form and pattern is almost unrivalled in Nature, diatoms inhabit the waters in incredible numbers. These one-celled plants average less than $\frac{1}{250}$ of an inch in size, yet they provide the basic food of all animal life in the sea, and their fossil shells are put to many commercial uses. The photomicrographs above show us 11 of the 8,000 known species. 1, A six-angled form with delicate lacework. 2, Boat-shaped and striated. 3, Nine-angled, with honeycomb pattern and a scroll. 4, Linear, resembling a lady's brooch. 5, Circular, "The Shield of the Sun". 6, Rectangular, ornamented with a scroll. 7, Oval, with radiating lines. 8, A "double" diatom. 9 to 11, Triangular forms, one concave and two convex, one straight sided.

How our PLANT NEIGHBOURS Live

Not everyone realizes what a full and complex life is led by the plants—quite as fascinating in its way as that of the animal kingdom. This article provides an introduction to this interesting subject

Plant Life. The first thing to keep in mind about plants is that they are *alive*. They eat and drink, and also breathe and move, they rest and sleep, live and die, in much the same way as men and animals. They grow strong and healthy with plenty of good food, but pine if the food is bad or scarce.



Kodak Snapshot

It is difficult to distinguish exactly between the lowest forms of plants and the lowest forms of animals. What are the "slime

moulds," for instance, which creep as white films over damp rotting wood in dark places—plants or animals? Scientists themselves disagree on the answer to this question.

The next step upwards, however, brings us well inside the gates of plantdom. Here we find a great group called the *algae*, from which all other plants are believed to have evolved. These are water dwellers as a rule, though some have learned to live in moist places in the open air.

The redness of the Red Sea is caused by certain tiny forms of algae, as well as the "red snow" reported by Arctic explorers. More familiar types of these plants form the green "scum" which gathers on the surface of still waters, and those net-like masses of green which wave from their moorings on stones at the bottom of slow-moving brooks. And the higher algae you all know—they are seaweeds. (See *Algae*).

And then we come to the great group of the *fungi*. These are the "black sheep" of the vegetable kingdom—the outlaws, so to speak. For, although many of them are among the most useful of living things, others are exceedingly harmful—and not one of them is governed by regular plant rules. You will know them by their names—the bacteria, the yeasts, the moulds, the mildews, the blights, the rots, the rusts, the smuts, the mushrooms and toadstools, and the like. (See *Fungi*).

An interesting side-line is that of the *lichens* (*qv*), which consist of a fungus and an algae living in close co-operation.

Next come the *mosses*, the living carpets of the woods, Nature's upholstery. It may come as a surprise to those who think "moss is just moss" that about 17,000 kinds have already been recognized and named. Many interesting things about them are told in the article on *Moss*, particularly the extraordinary manner in which they multiply. Close to them are classed the *liverworts*, those curious sheets of green or grey matter which grow on damp walls, etc.

Members of the next group you will also find in the shaded woods and on the edges of quiet waters. They are the *ferns*, which include not only the true ferns, with their delicate and beautiful fronds, but the horse tails and the club mosses also.

The members of this group were perhaps the first to rear themselves above the ground.



TOOTHWORT, A COLOURLESS PARASITE

This curious looking plant is called toothwort, and indeed its strange white flowers do look rather like teeth. Sometimes they are tinged with purplish-pink, and this is the only colour on this plant, for it is a parasite on hazel roots and so needs no green chlorophyll to help it to manufacture its food.

and to stand alone. In fact, millions of years ago the ferns and their relatives were the largest of plants, and covered the earth in vast forests, the remains of which form the great coalbeds in the earth today. Although some of the ferns at present grow as big as small trees, the group as a whole has fallen off in size and importance (See Ferns).

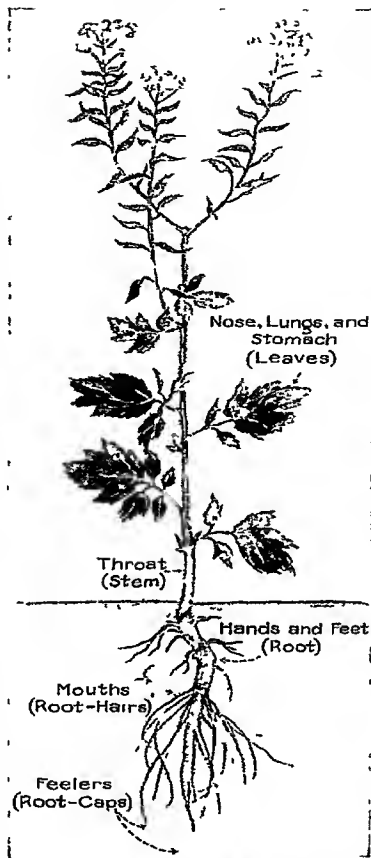
The last and greatest group includes all the "higher" plants, which are distinguished as *flowering plants* or *seed plants*.

It is the green colouring matter in plants that enables them to take "dead" substances from the air and soil and manufacture living food. In all Nature plants alone can do this, and this governs most of their differences from the animals.

What about the plants that have no green colour, such as mushrooms? They are the "outlaws" of which we spoke earlier. The whole group of fungi, together with a very few other plant species, lack this green colouring matter and so are unable to make their own food. They get their food either from the living bodies of animals and other plants, in which case they are called "parasites," or from decaying animals and plants, when they are "saprophytes."

The bacteria of disease, the blights and rusts, the various forms of rot that afflict growing fruit, etc., offer examples of the parasite class, while many of the mushrooms and toadstools, as well as a number of higher plants, are saprophytes. These two classes of plants acquired the habit of living on the work of others and so lost the power of manufacturing their own food.

Outside these two classes all the other plants contain green colouring matter—even those algae



THE PARTS OF A PLANT

Here we see the "organs" of a typical plant and the work they do. Let's begin at the roots. The main roots grip the ground and hold the plant in place, while the root-caps feel their way through the soil in search of moisture. The root-hairs draw in this moisture and the minerals it contains, and send them up through the "arteries," which lie beneath the waterproof "skin" of the plant, to the leaves. The leaves "breathe in" not only oxygen from the air but also the major part of the plant's food (carbon dioxide), and digest it with the aid of water and minerals. The whole is held together by the "skeleton" of stem and branches

magnesium, sodium, and iron

We must not imagine, however, that plants do not need to breathe. They need oxygen and

which have other colours so mixed with it that they appear brown or red.

The marvellous green substance which makes plants the greatest factories in the world is called "chlorophyll." It is contained in the cells of leaves, and often in the stem and flowers. By the aid of the chlorophyll the energy of sunlight is used to separate the carbon from the oxygen in carbon dioxide and to manufacture certain organic compounds, out of which the plant builds its own body. Now, when that plant body or any part of that plant body—leaves, roots, stems, or fruit—is consumed by being eaten or by being burned, the carbon eventually unites with oxygen again, and the energy from the sunlight that was used to build the plant body is turned loose again for some other work.

Thus the circle is complete. Plants take in carbon dioxide, use the carbon to build their own bodies, and store up energy in the process. The materials of the plant bodies are eaten by men and animals and so built into human and animal tissue. This tissue is then used up in active living and its energy released—carbon dioxide being again formed in the process.

The substances with which the carbon from the air is combined are all obtained by the plant from the earth. Water, from which the plant takes hydrogen is the most important, and with the water there are certain minerals needed in building various parts of the plant body. These minerals are principally compounds of nitrogen, sulphur, phosphorus, potassium, calcium,



carbon dioxide, and when they breathe, they also produce carbon dioxide. But during the daylight hours when they are making their food, they use up all the carbon dioxide that their breathing produces and a great deal more besides so that a large surplus of oxygen goes out free into the air again. At night, however, when there is no light and, therefore, the carbon dioxide cannot be broken up in making food, the plant must get its oxygen from the outside air and must also release a certain quantity of carbon dioxide. That is why flowers are taken out of the sick room at night, since carbon dioxide makes the air bad for human lungs.

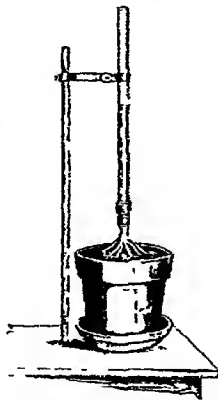
In all green plants this breathing is carried on principally by the leaves. Certain saprophytic plants, like the yeasts, which do not live in the air, get the oxygen they need by extracting it from the substances in which they are contained. The changes they cause by taking this oxygen are called *fermentation* (See Fermentation, Yeast).

The manner in which the higher plants draw water from the soil and carry it through stem and branches to the leaves is one of the most marvellous facts of science. It can easily be illustrated in the following way. Fasten a small sack, made of some membrane (say, parchment) over one end of a long glass tube, and pour into



PLANTS' FEATS OF STRENGTH

Who can call plants feeble when even mushrooms can burst their way through pavements, and trees can split great boulders? This power of expansion is due to growth and the internal pressure of the sap. Note also the ripe tomato, burst open by the pressure of sap.



Here the stem of a plant has been cut off near the roots, and a glass tube has been fastened in its place. Notice how osmosis has forced sap up into the tube.

the tube a sugar solution. Now plunge this end of the tube into a jar of water and fasten it in place. The water will be drawn from the jar through the parchment, and the liquid mixture will rise in the tube until within two or three days it reaches 2 feet or more.

The process is called *osmosis*.

It always takes place when two liquids, one of them containing some other substance in solution, are separated from each other by a suitable membrane.

The weaker liquid passes through the membrane and mixes with the stronger—Nature's effort towards an equilibrium in which both solutions are equally strong.

This is precisely what happens in plants. Among the things manufactured by the plant from carbon is sugar, which is dissolved and distributed in the form of sap through each living cell in the entire plant structure. The outer covering of the tiny root-bars consists of a very effective membrane, and so do the walls of the individual cells. You can see, then, how by osmosis water is drawn into the roots.

Various theories are advanced to account for the rising of water in the plant or tree after it has been drawn in by the roots. Osmosis can account for only a part of the process, and one of the best explanations for the remainder of the action is as follows: In the plant there exist connected columns of water from root to

PLANT LIFE

leaf The leaf gives off much of its moisture to the air by transpiration. This probably exerts a "pull" at the top of these columns of water, and the whole columns move up without leaking, owing to the enormous cohesive power of water.

It is this pressure which helps to hold young stems and flowers rigid and which causes over-ripe fruits such as tomatoes or plums to burst. It supplies the energy by which buds and flowers swell and unfold, and by which young roots force a way through hard soil.

To sum up, then, we may say that green plants eat and breathe principally with their leaves and drink with their roots. The roots produce sensitive fingers that feel their way through the soil, dodging round rocks and picking up moisture, which is carried up through the trunk and branches, out through delicate veins to the leaf tip, where it is transformed and carried down again to build up the life cells. Plants need, above all things, air, sunshine, water, and the minerals from the soil which are dissolved in the water. Next to these bare

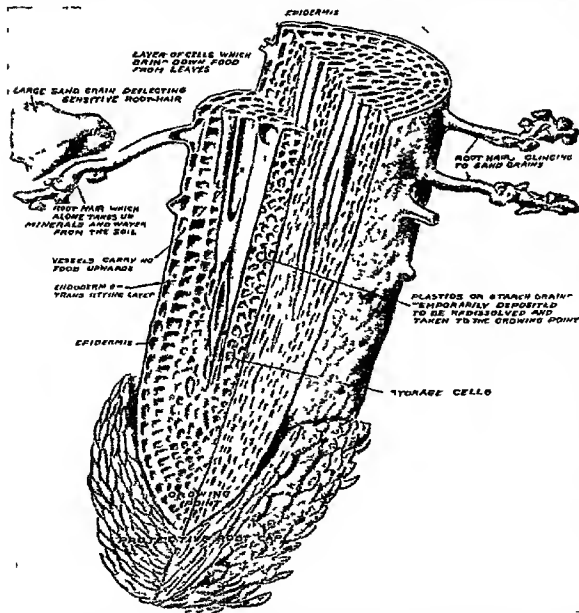
necessities of life, they must protect themselves and reproduce themselves constantly to prevent their race from dying out.

The soaring trunks of trees, the clinging tendrils of vines, are devices evolved by these plants for getting up into free sunshine and air. The great number of branches with their countless leaves, spread out like so many begging hands, show us how the tree tries to get as much sunlight on its "skin" as possible. The tough and waterproof bark was developed to protect the delicate tissue inside against the attacks of animals and fungi, as well as to prevent the life-giving sap from running out or drying up. Thorns serve to drive off browsing animals.

Flowers have brilliant hues and delicate odours, and produce sweet nectar, all to attract those insects which will act as agents of fertilization, bringing pollen from one flower to the stigmas of another. To make sure that the seed will not fall upon crowded ground and have its young life choked out by older plants, provision is often made for carrying it far away from its parent. Either the seed or the whole fruit may have tiny hooks which catch in the fur of roving animals, as in the "burs" of the burdock, perhaps they are downy wings or leafy gliders, on which it drifts with the wind, as in the "samaras" of the maples, perhaps it is surrounded with a sweet pulp, forming an edible fruit, which birds or beasts will eat, dropping the undigested seed in some distant planting ground. (See Flowers, Seeds and Spores.)

The efforts of all plants to obtain as much food as they can for themselves, and to provide as well as possible for their young, produce a great struggle. For there is not room enough on the earth for all the plants and their seeds, nor is there always enough sunshine and water. So they must fight for what they get—not by attacking one another as the animals do, but by pushing and crowding, by sending out the first or the longest roots, by spreading out the highest or the most leaves, by attracting the most insects or sending out the strongest suckers, by taking advantage of every opportunity that offers.

In addition, plants have also to battle against heat and cold, drought and flood. Only plants specially adapted can withstand the low temperatures and the long nights of the polar regions, or



THE ROOT-TIP, ORGANIZED FOR WORK

In this drawing the root-tip's organization is made clear. The growing point is shielded by a cap of cells which are continually being pushed forwards, while food comes from the leaves above, and water from the root-hairs.

find sufficient nourishment in the thin air of high altitudes, or keep their sap running in the dryness of the desert.

If you take an ordinary bean and lay it on damp ground, it will sprout, sending a root into the earth and erecting a stem into the air. If you now turn this sprout upside down, so that its root points upwards and its stem downwards, you will notice in the course of a day or so that the tip of the root has curved over towards the earth again, and the stem has turned upwards away from the earth. This curious instinct of the plant, which makes it sensitive to the force of gravitation, so that it will right itself after being upset, is called *geotropism*, "earth turning."

Turning towards the Sun

Even more curious, perhaps, is the varied sensitiveness of plants to light, called *phototropism*, i. e., "light turning," or *heliotropism*, i. e., "sun turning." If a mustard seed lies supported on the surface of a jar of water which contains the necessary minerals for its growth, it will sprout and develop just as if it were planted in the soil. If the jar is placed in a room some distance from the window, it will grow in a curious way. The stem will bend directly towards the light, the leaves will turn their surface at right angles to the light, so that their faces catch the most rays possible, and the submerged roots will turn away from the light. It is just the same impulse which forces the trees in a closely packed forest to send up long straight trunks, since their only chance of light and air is to outstrip their rivals, whereas the tree in

the open spreads sideways. Certain plants in hot countries escape the danger of getting too much heat from the sun by turning the edges of their leaves in its direction. On the other hand, we know how sunflowers, which need a great deal of light, follow the sun through the day.

But perhaps the most remarkable instance of phototropism in plants is the way the leaves on a tree will twist and turn and arrange themselves so as to avoid the shadows of the leaves above them. Even the sizes and shapes of the leaves of different plants are believed to be determined by the amount of light they need. Trees such as willows, with their open system of branching, have numerous small leaves, the horse chestnut has fewer leaves, very large but cut up



Harold Bastin

BURRS FOR SPREADING SEEDS

The burdock is one of the many plants which take special steps to ensure the spreading of their seeds. The bracts surrounding its flower head have curved hooks, which catch in the wool of sheep or the fur of other animals and are thus transported to new ground.

into a number of spreading segments, letting light through to those below. Plants sprouted in the dark remain white, for they have no use for chlorophyll, but they turn green as soon as they are exposed to the light. This peculiarity is made use of in blanching such vegetables as celery and asparagus. The habit in certain plant families—clovers and beans are examples—of drooping their leaves at night, so that it looks as if they had gone to sleep, is an extreme example of phototropism.

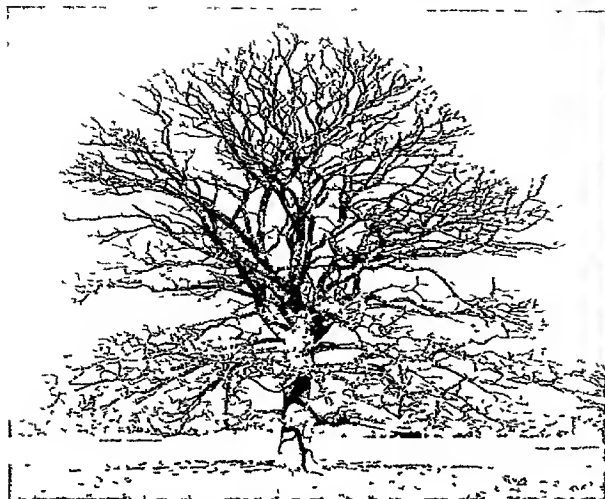
If a plant gets plenty of light, it is also bound to get plenty of air, so that the examples of "air turning" are not conspicuous. Other reactions of a similar type are *chemotropism*, turning towards a chemical stimulus, and *hydrotropism*, or turning towards moisture. Drain pipes and sewers are often stopped up by the thirsty roots of poplar trees, which feel their way through crevices in pipes or tiles to get the water they so much need.

Certain plants send down enormously long roots to reach deeply buried moisture,



LILY AWAKE AND ASLEEP

At the top the water lily is folded up and drawn partly down into the water for the night. Below, it is open for the day. This is an example of the "light-sensitiveness" (phototropism) so common in plants.



THE STRUGGLE FOR LIGHT AS SEEN IN THE OAK AND PINE

All green plants do their utmost to get the most light they can, and these pictures show two ways in which they set about it. The oak (left) growing out in the open, spreads its branches on all sides, reaching outwards to obtain the maximum of light. The pine trees (right), unable to reach sideways because of their neighbours' competition, struggle upwards with straight, long boles, their lower branches, deprived of daylight, have died off when quite small.

Photos left E. J. Hocking right E. O. Mansell

passing through many feet of dry soils on the way, on the other hand, trees growing in swamps, where there is danger of having their roots "drowned" by excess of water, will sometimes raise a portion of the roots above the soaked ground so that they can get air.

Lastly, we come to the remarkable sensitiveness to touch of many plants. Everyone has seen climbing plants send out into the air long tendrils, which start curling round a wire support as soon as they touch it. That this is due to the plant's sense of feeling can be easily proved by a test. Rub one side of the tendril's tip with a small stick or the point of a pencil, and it will start to curl in a very short time, though it will straighten out again if you do not repeat the performance.



MOST SENSITIVE OF PLANTS

A member of the mimosa family, the "sensitive plant" is famous for its quick reaction to touch, to extreme heat and to bright light, all of which will cause the sections of its compound leaves to fold up rapidly.

Certain kinds of ivy will even produce new climbing roots at places where a new contact is felt.

The well known "sensitive plant" droops promptly at a touch, at the approach of any red hot object, at a light strongly focused, or at the feel of a drop of acid on its leaves.

Let us now turn to those methods by which plants guard themselves against special dangers.

We know that trees constantly exposed to strong winds tend to brace their roots and to strengthen their cellulose skeletons. We also know that evergreens growing in regions of great snowfalls build thicker layers of wood on the under-sides of their branches, and even regulate the arrangement of their branches, to avoid breakage by snow.

PLANT LIFE

Under the influence of extremely dry climates plants have developed some very ingenious habits concerning water absorption. Some desert plants have produced a stronger sap, which, as we saw in the description of osmosis, enables them to absorb water more powerfully. Others, like the cacti, have developed large cell cavities for storing water. At the same time they have reduced to a minimum their outer surfaces through which water might evaporate, by losing their leaves and all projections not absolutely necessary for getting light and materials for food making. For the plant moisture escapes through the same tiny openings or "stomata" on the green surfaces which admit carbon dioxide to the plant. Some desert plants have solved the difficulty of water supply by confining their active life to the short rainy season, spending the remainder of the year in a half dried and resting state.

We have seen that nitrogen is one of the important elements which plants must get. They cannot absorb it in its pure state, but must get it in the form of "nitrates" from the soil. (See Fertilizers, Nitrogen). Now, wild plants often live in places where nitrates are scarce in the soil. Swamps and bogs are particularly lacking in this respect, for the nitrates dissolve in water and are washed away.

To supply this deficiency, certain plants have developed the faculty of catching and eating insects, whose bodies are rich in nitrogen compounds. These are known as "carnivorous plants" (See Pitcher plants). There are water plants, such as the bladderwort (*Utricularia*), which catch minute aquatic creatures for the same reason; these victims enter the tiny "bladders" easily, but a ring of hairs projects inwards and prevents their escape. They eventually die, and the plant then feeds upon their decaying bodies. Other examples of carnivorous English plants are the sundews (*g v*) and the butterworts, found in moist places.

Certain forms of bacteria have the unusual power of forming nitrates out of pure nitrogen taken from the air. The members of the pea family have formed an alliance with such bac-

teria, they colonize them upon their roots, thus making sure of a constant and plentiful nitrate supply. In return, the plant supplies its tiny cousins with foods, which they are unable to manufacture for themselves. (See *illus* page 386).

How long do plants live? We all know the *annuals*, which flower the same season they are planted, and then, throwing all their strength and reserve food into their seeds, wither and die, root and branch, in one year, and the fungi of course, which may last only a few days. The *biennials* make only leaves and buds the first



THIS PLANT EATS INSECTS!

Quite a number of plants have found how to live at the expense of members of the animal kingdom, and here is one of them—the butterwort, which grows in wet, hilly districts. Its pale leaves have a sticky surface which traps small insects that settle on it, the leaves' edges then curling in until the victims have been digested.

season, and store up food in their underground parts, their upper parts dying down in the winter. Examples are the root vegetables of the garden and many common flowers. The next season the reserve food from the root part is used to make new stems, which bear flowers and seeds, after which the plants perish completely. The majority of wild plants, however, are *perennials*, which go on living from year to year. They may sleep throughout the winter, storing their food in root or stem and perhaps dying

right down to the roots, or they may go on growing, in which case they usually become shrubs or trees.

Trees keep on growing in the fullness of their vigour until then very size makes the problem of food and water transmission difficult. Perhaps a weakened branch then breaks off under its own weight, the deadly

100-producing fungi enter through the open wound, and soon the giant is brought to the ground. Under favourable conditions, however, trees may live for hundreds of years, and some, such as the yew, oak, or plane, may exceed 1,000 years.

Most plants in favourable situations manufacture much more food than they themselves use up, storing the surplus in various parts of their structure. It is upon this surplus food of the plants that Man and other animals feed, either directly or indirectly. Sometimes this

surplus is found in the foliage of bushes and trees, or in the stems and blades of grasses. Sometimes it is stored in the underground parts, such as roots or bulbs (See Bulb). Again, it takes the form of a supply which the plant has laid by for its own seedlings, as in the grain seeds, nuts, beans, peas, etc., where a large amount of concentrated nourishment surrounds the plant germ.

Agriculture began when Man selected those particular wild plants which were rich in stored foods, sowed their seeds, and protected the growing plants in his fields and gardens. Removed from the dangers and struggles of their former existence, they have been able to devote more and more energy to the business of making and storing food. Thus our wheat, which was once a wild grass, has developed the rich seeds which give us our flour. The process of evolution is further speeded up when men carefully select their seed for each

HOW PLANTS ARE CLASSIFIED

- Group I Thallophyta, including algae, fungi, bacteria, lichens
 Group II Bryophyta, including liverworts and mosses
 Group III Pteridophyta, including ferns, horse-tails, and club mosses
 Group IV Spermatophyta, or seed-producing plants
 (1) Gymnosperms, including the conifers
 (2) Angiosperms, the true flowering plants. These were the latest plants to be developed in the history of the earth, and they have the most complicated structures. They are divided into:
 (a) Monocotyledons, such as the pond-weeds, grasses, sedges, palms, lilies, orchids, etc.
 (b) Dicotyledons, including all the other herbs and shrubs, and the broad-leaved trees (i.e. all except the palms and conifers).

different species. Luther Burbank (q.v.) was one of the first great plant-breeders (See Heredity).

Besides food, plants provide us with many other very useful things—wood, cotton, and linen cloth, the paper on which our books are printed, etc. Plants also supply us with countless drugs and oils and perfumes, with the fibre out of which so many new synthetic materials have been made, with materials for soap making, and, indeed, with substances which enter into almost every industrial process.

Thus, though at first the life of a plant may seem dull, sluggish, and uninteresting, we can soon find out, if we have a little patience, that plants have many exciting adventures. The story of their struggle, of the ingenious ways in which plants outwit their foes, overcome the obstacles that beset them, and keep their races alive—this is the story of plant life. A useful classification of the plant world is given in the panel above.

Plastics. Until recently the only known plastics were pottery clay and glass (See Clay, Glass). But a group of substances, known as resins (q.v.), came into use for the manufacture of gramophone records and electrical insulators. The demand for these resins grew to such an extent that there was soon a serious shortage of them. The fossilized resin—amber—formerly a curiosity, soon became immensely valuable.

This encouraged scientists to find a synthetic resin, a quest which resulted in the



PEN OF TRANSPARENT PLASTIC

How useful it is to be able to see at a glance how much ink is left in the pen! This is possible with some fountain pens, like the one shown here, because the barrel is made of transparent synthetic resin with black and coloured bands.

Courtesy of Parker Pen Co. Ltd.

PLASTICS

discovery of a group of substances known as the phenol formaldehyde resins or *bakelite* (See Coal-tar Products) You know that wood consists of very long, tough fibres that make it both strong and pliable These modern plastics are made of substances whose molecules hook into one another at both ends, thus building up long, pliable, molecular "fibres"

Bakelite is obtained ready-mixed with "fillers"—hardening compounds and colouring matter—in the form of a dry powder This is placed in a metal mould and a pressure of 2,000 pounds per square inch and a temperature of 300° Fahrenheit are then applied for several seconds When the pressure is released the article is ready to be removed and polished

Bakelite was used with great success in the manufacture of electrical goods and silent running gear wheels But owing to certain difficulties in colouring the material in brilliant hues, it has been largely superseded by another group of resins, known as urea-formaldehyde compounds These can be produced quite transparent and colourless, thus giving the colouring materials an opportunity of showing up brilliantly The dyes and opaque fillers are added whilst it is being prepared, not after it has been powdered for the moulding process

Other familiar plastics are *celluloid*, used for making dolls, bicycle mudguards, combs, accumulators, etc., and *cellulose acetate* (see Pyroxylin), made from cotton, *vulcanite*, which is rubber hardened with sulphur, and *erinoid*, now used chiefly for knitting needles, which is mainly casein, a substance obtained from milk

The new transparent resins, being much lighter than glass, are being used extensively in aircraft construction wherever glass was formerly used Transparent fountain pens and pencils, wireless cabinets, spectacle frames, lamp shades, and clocks are already on the market As each new type of resin is produced it seems to open up limitless fields in which it can be used with almost revolutionary results

Platinum.

Imagine a cube of silvery greyish-white platinum a foot each way Not a very great mass of metal,

PLATINUM

you might think But try to pick it up, a you would quickly find your mistake, platinum is one of the heaviest metals—near twice as heavy as lead—and this one-foot cube would weigh more than half a ton, while a similar cube of coal would weigh only about 40 pounds If you possessed such a mass of platinum you would hold a considerable portion of the world's supply

When platinum was first discovered, nearly two centuries ago, it was so cheap that the Russian government used it for lesser coinage as we do copper Its amazing increase in price is due to its scarcity and to its being indispensable in chemical and electrical apparatus

One of the most useful properties of platinum is its chemical inertness It is one of the so-called "noble" metals, resisting the attack of any of the common acids singly, though it dissolves in a mixture of nitric and hydrochloric acids Platinum and gold are the only metals that successfully resist the attack of the acids in the mouth, and hence they are extensively used in the making of dentures The chemist finds platinum indispensable for crucibles and other articles of laboratory equipment, because of both its resistance to acids and its high melting-point, 3,183° F

Platinum expands less under heat than any other metal One of its most important properties is that under rising temperatures it expands at nearly the same rate as glass Until recently it was the only otherwise suitable substance with this property, and so it was extensively used in electric light bulbs A less



FORGING A PLATINUM INGOT

Above is seen a corner of a London refinery of rare metals The workman is engaged in forging a 400-lb. ingot of pure platinum This precious metal is much favoured by jewellers on account of its beautiful colour, its useful working properties, and its ability to resist oxidation and the action of acids It forms alloys with most other metals, and finds a use in many branches of industry, especially for chemical and electrical apparatus

Courtesy of Johnson, Matthey & Co. Ltd

expensive substitute has now been found, however—an alloy called *platinate*, made of iron and nickel. Another interesting property of platinum is its extreme ductility, it can be drawn out into a thin wire as fine as or finer than a spider's thread. An ounce of the metal drawn out like this would extend over a distance of several hundred miles.

In its finely-divided forms, such as platinum sponge, platinum black, and platinized asbestos, it is one of the most useful of the "catalysts," a catalyst being a substance which brings about

being itself affected by any permanent change. For instance, at ordinary temperatures hydrogen and oxygen are indifferent to each other. But hold a bit of spongy platinum in a stream of escaping hydrogen, and the hydrogen will unite with the oxygen of the air, that is, it will take fire. So, too, in the contact process for making sulphuric acid, platinized asbestos is used as a catalyst.

The alloy of platinum with iridium, another metal of the platinum family, is one of the most resistant metals known, so far as the wear of time and use are concerned. On this account it is used for making national standards of weight and measure, and also for the writing tips of fountain pens. It is used, also, in making platinum photographs and for jewelry.

The name "platinum," a diminutive of the Spanish *plata*, silver, was given to it because of its resemblance to silver. Platinum is found usually in small grains or flat scales, sometimes in nuggets, generally associated with gold and with one or more of five other rare metals, namely, iridium, osmium, palladium, rhodium, and ruthenium.

Of the world's annual production of platinum metals, the largest output comes from Canada, the Ural Mountains in Russia, and Colombia (where platinum was first discovered). Other regions where the metal is found include South Africa, Australia and Tasmania, Alaska, Burma and Japan.

Plato. (Pron plá'tō) (427-347 B.C.) Of all the sages and philosophers of antiquity, Plato is the best-known and the most widely quoted. Succeeding generations have clothed his name in a cloud of intellectual romance, and his many writings have been made the basis for an endless number of moral, religious, and political doctrines.

Born of aristocratic parents, Plato received the customary Athenian education in poetry, music, oratory, and gymnastics, and at about the age of 19 became a pupil and friend of

the great Socrates. Plato remained with Socrates until the latter was put to death by the Athenians, in 399, assisting and defending the master at his trial (See Socrates). This association had the profoundest influence on the young man and shaped all his later thoughts and writings.

The next ten years Plato is said to have spent in travel, visiting Egypt and other countries on the Mediterranean. The story goes that in Sicily he incurred the enmity of Dionysius, tyrant of Syracuse, who caused him to be sold as a slave, and that he was ransomed by one of his friends. He set up a school in the famous grove named Academus, a pleasure-ground about a mile outside Athens. There beneath

the lofty trees Plato taught philosophy to the youth of Greece, until his death at the age of 80, and thus the word "academy" received the associations it has ever since borne (See illustration in page 19).

Plato's fame spread over all the civilized world, and brought him many pupils who later became famous. Chief among these was Aristotle, who was destined to surpass even his master in certain departments of philosophy, (see Aristotle), another was Xenocrates, who became president of the Academy in 339.

Plato left behind him a great number of works, mostly in the form of dialogues, in which Socrates appears as the leading character. It is chiefly through the mouth of his old teacher that Plato sets forth his doctrines, which are



PLATO AND ARISTOTLE

Here we see on an enlarged scale the two central figures of Plato (left) and Aristotle from Raphael's "School of Athens," reproduced in its entirety in page 3210. Plato was the greatest of the Greek philosophers, and Aristotle his most famous pupil.

presented in the Socratic method of reasoning by question and answer. Written often in a high, almost poetic vein, they are nevertheless examples of severe and subtle thinking. Benjamin Jowett (1817-1893), the distinguished English scholar whose translations of Plato have taken a high place in English literature, said that "the germs of all ideas, even of most

Christian ones, are to be found in Plato." The best known of Plato's works are the "Republic," in which he outlines the ideal government, the "Symposium," in which a group of guests at a banquet discuss ideal Love and Beauty, and the "Apology," which is not in dialogue form, presenting a vivid portrayal and defence of Socrates.

CHILDREN'S GAMES *all OVER the WORLD*

After explaining the pleasure and profit to be got from play, this article describes some popular games played in many countries. So, when you want a game to play, turn to these pages for ideas.

Play and Games. Play is as important to a child as school-work, for it is an essential part of his physical and mental growth. The child becomes what he is as a result of what he does. Nature decrees certain activities and builds the body round them. No child can refuse

to play and still develop a well-balanced character. Playing games is an instinct, having been handed down through unnumbered ages. The play instinct is fostered by the establishment of school playgrounds and recreation centres, under the supervision of trained instructors

who teach what games to play and how to play them. (See Physical Training.)

The boy who is compelled to live in the city has little room for wholesome play. He has nothing but the street for a playground, and nothing in the street provided for his play. Give him a chance to show his worth, provide him with an opportunity to perform difficult feats on a horizontal bar or from a diving-board, and the juvenile court will be deserted for the playground.

The Duke of Wellington said that Waterloo was won on the playing-fields of Eton. Athens and Rome had their intellectual supremacy because they built a perfect body for men and women, knowing that a healthy mind would follow. No brain can work properly without the nourishment of strong blood. No



'KNUCKLING DOWN' FOR 'RING TAW'

Fox Photos

Here are children of the Whitwood Mere School, Castleford, Yorkshire, playing in a marbles tournament to discover the best player in the school. The best marbles-player in each of Castleford schools takes part in a championship contest held on Shrove Tuesday. The game being played above is known as "Ring Taw," and the position of the players' hands, with the knuckle of the forefinger touching the ground, termed "knuckling down," shows the correct way to shoot the marble.

vile thoughts can come from a brain fed by organs neglected throughout life. A properly nourished body, one with well-trained muscles and organs, will furnish a mind with initiative and unselfishness. It is a child's right to have ambition to be a leader, and we do not accord

him his privilege if we withhold the opportunity to build a body that will make his brain active.

The following games are of value in bringing out that desirable idea of leadership in the child, and in developing the qualities of fair play, mental alertness, and physical strength.

Games for the Younger Children

CAT AND RAT. This game is for 10 to 30 or more players. One player is chosen for the cat and another for the rat. The other players form a circle by clasping hands. The cat is on the outside of the circle and the rat inside. The game opens with a conversation between the cat and the rat.

The cat says, "I am the cat." The rat says, "I am the rat." The cat says, "I will catch you!" The rat says, "You can't!"

This remark of defiance starts the chase. The cat tries to get into the circle after the rat, but the rat evades him by running in and out of the circle. The rat is assisted by the players, who raise their hands to let him through, but the cat is prevented by the players, who try to keep him on the opposite side of the circle.

When the rat is caught, he joins the circle. The cat becomes the rat and a new cat is chosen.

DROP THE HANDKERCHIEF. For from 10 to 30 players, indoors or out of doors. All of the players but one stand in a circle. The odd player runs round the circle carrying a handkerchief, which he drops behind one of the players in the circle. He must try, if possible, not to let any of the circle players know where he is dropping the handkerchief. He may resort to various devices for misleading the others by quickening his pace or slackening it as he desires, or by making a mere pretence to drop the handkerchief.

As soon as a player discovers that the handkerchief has been dropped behind him, he must pick it up, leave his place vacant, and chase the one who dropped it. If he catches this leader before the latter reaches the vacant place, the

leader is a "lazy-bones," and must sit in the circle for the rest of the game, and the player who caught him next drops the handkerchief. If the leader, on the other hand, drops the handkerchief behind a player and gets round the circle back to that player before the latter picks up the handkerchief, the latter is the "lazy bones."

FOLLOW-MY-LEADER. For any number of players. One player, who is specially resourceful or skilful, is chosen as a leader. The others all form in a single file behind him, and imitate anything that he does. The leader aims at keeping the line moving and should set particularly hard tasks for them—such as climbing or vaulting over obstacles and under others, jumping certain distances, taking a hop, skip, and jump, walking backwards, turning round while walking, walking or running with a book on the head, etc. Anyone failing to perform the required feat drops out of the game or goes to the foot of the line. At the pleasure of the players he may pay a forfeit for the failure and continue playing. All forfeits are to be redeemed at the close of the game.

HERE'S A BALL. Finger plays, such as "Pat-a-cake," have always been popular. One of the favourites is "Here's a ball for Baby," played as shown below.

Here's a ball for Baby,
Big and soft and round!
Here's Baby's hammer—
O, how he can pound!
Here's Baby's music—
Clapping, clapping so!
Here are Baby's soldiers,
Standing in a row!

Here is Baby's trumpet,
Toot-toot toot! too too!
Here's the way that Baby
Plays at "Peep-bo!"
Here's the big umbrella!
Keeps the Baby dry!
Here's the Baby's cradle,
Rock-a-baby-by!



'HERE'S A BALL FOR BABY'—A FAVOURITE OF THE VERY YOUNG

A small baby, even before he can talk, enjoys hearing his mother recite "Here's a ball for Baby," with the gestures as shown. The first picture represents the ball, 2 the hammer, 3 the music, 4 the soldiers, 5 the trumpet, 6 peep-bo, 7 the umbrella, and 8 the cradle. The verses are given in full in the text above.



FOX PHOTO

THE 'CONKERS' SEASON OPENS IN AUTUMN

With the coming of autumn and the horse-chestnuts, schoolboys return again to the popular game of conkers. The object of this game, the name of which is a corruption of the word conquerors, is to split the opponent's chestnut or 'conker,' by a well-aimed blow. The two boys above come from Bristol, a part of the world where schoolboys greet the opening of the 'conker' season with the ritual cry of 'Oily Oily, Onk my first Conk!'

Games for the Older Children

TWOS AND THREES This game is simply our old-fashioned "Touch" elaborated. The players, grouped in couples (one player behind another), form a large circle, facing in. One player is selected as a runner, and another is "he," or the chaser. The chaser attempts to touch the runner, who endeavours to escape by dodging in and out of the circle. The runner being chased eventually stands in front of any couple, making "three deep." This crowds off the rear player of the original couple. He immediately becomes the runner and is chased until caught, or until he saves himself by standing in front of another couple, making it "three deep," and crowding off another player. When the chaser catches a runner, the positions are reversed. This is a game that gives every player a chance, instead of being a game for the few fleet of foot. The uncertainty and the many rapid changes keep every player alert.

PUSS IN THE CORNER All the players but one stand in corners or convenient goals. The odd player goes from one to another saying, "Pussy wants a corner." The player addressed answers "Go to my next door neighbour." In the meanwhile the other players watch their

opportunity to exchange places while Puss is attracted in some other direction. Puss should promptly get into one of the vacant places.

The sport of the game consists very largely in tantalizing Puss by making many exchanges, or, on the other hand, in Puss suddenly dashing for some vacant place without giving previous evidence of knowing of it. When Puss secures a corner, the odd player becomes Puss. If Puss does not succeed in getting a corner as desired, he may call "All change!" and all the players must change places. Puss then can usually slip into a place.

SPIN THE TRENCHER All players but one are numbered and seated in a circle. The odd one stands in the centre and twirls a trencher, plate, or other flat, round object. As he starts to spin he calls a number, and the player bearing that number must spring up and catch the plate before it stops spinning and falls to the floor. If successful he returns to his place, if not, he takes the place of the spinner and pays a forfeit. The forfeits are redeemed at the end of the game. Instead of numbers, names may be used.

FRONK IN THE MIDDLE One player is chosen for the frog and sits in the centre on the floor

with his feet crossed in tailor fashion. Where there are more than 20, it is well to have two frogs. The other players stand in a circle around the frog, repeating, "Frog in the sea, can't catch me!" They dance forward towards the frog, tantalizing him and taking risks of being caught. If the frog touches one of the players, he exchanges places with him. The point is that the frog must not at any time leave his sitting position until released by touching another player.

POTATO SPOON RACE This is a form of potato race that is good fun. The players are divided into two or more groups which compete against one another. Each group lines up in single file, so that the leaders all toe a starting line. Placed on the floor in front of each group and stretching ahead in the same direction should be a row of potatoes at intervals of two or three feet apart, one for each player in the file. The larger and more irregular in shape the potatoes are, the better. There should be from six to ten potatoes in a row. Each leader has a teaspoon and beside him is a pan, box, or basket in which the potatoes are the own

At a given signal each leader starts forward, takes up a potato on the spoon, carries it to the basket or box, and places the potato in it. He then hands the spoon to the next player, and passes off the playing-field, not lining up again with his team. The second player picks up the next potato, puts it in the basket, and so on until all have played. The last one stands beside the box with the spoon held aloft as a signal that he has finished.

No player may touch the potato with any thing but the spoon. Should a potato be touched otherwise, the player must replace it and pick it up again on the spoon. Should a potato drop off the spoon it should be placed on again and the game continued from this point.

The game may also be played in the following manner. Ten potatoes are placed five feet apart in rows from the starting line. At the signal "Go!" the racers (one runner for each row of potatoes) run from the starting line and pick up the potatoes one at a time, returning to place them in a box or basket behind the starting line. The player getting all his potatoes into the box first wins.

Indoor Games for Rainy Days

THE PARSON'S CAT The first player says, for example, "The parson's cat is an avacious cat," using an adjective which begins with "a" to describe the cat. The next player makes a remark about the cat, using the same initial letter for the adjective, for instance, that it is an "aggressive" cat. The letter "a" is used

until the game has gone entirely round the circle, or until no player can think of another word beginning with "a." The first player then makes a similar remark about the cat, using an adjective beginning with the letter "b," and so on through the alphabet. Any player who is slow to respond, or who fails,

must either drop out of the game or pay a forfeit, as may be decided at the start.

SIMON SAYS Seat yourselves in a circle and choose one of the company to be the leader, or Simon. His duty is to order all sorts of different things to be done, the funnier the better. His orders, however, are to be obeyed only when the order begins with "Simon says." For instance, when he says, "Simon says, 'Thumbs up!'" all must obey, but "Thumbs down!" should not be obeyed, because the order did not commence with "Simon says."

Each time this rule is forgotten a forfeit



'SKATES-HOCKEY' IN A GLASGOW STREET

Of late years ice hockey has become extremely popular in Great Britain. The fertile school-boy brain soon found that a thrilling imitation of the world's fastest game could be had by substituting roller- for ice-skates. Walking-sticks and a tennis ball form the rest of the equipment, and woe to the pedestrian who unwarily steps across the line of the "puck!"

For Photos

OLD GAMES THAT STILL DELIGHT THE YOUNG



With what glee the little toddlers of the Open Air School in Regent's Park London, seen in the upper photograph, are romping along, bowing their hoops in the crisp sunshine of a fine winter morning! The lower photograph was taken in summer-time, and shows another bevy of gaily-smiling, care-free youngsters in Kensington Gardens, whirling giddily round in a grand game of "ring-a-ring-o'-roses!"

PLAY & GAMES

must he paid "Hands over eyes," "Stamp the right foot," "Pull the left ear," etc., are the kind of orders to be given

HISSING AND CLAPPING As many chairs as there are players are arranged down the middle of the room. The girls all sit down so that each has a vacant chair next her, and the boys retire from the room. During their absence the girls decide which particular boy is to occupy the vacant chair next each girl, and the boys are summoned in turn.

On entering the room the boy must walk straight to the chair next the girl whom he imagines to have chosen him, and sit down. If he has guessed correctly he is loudly clapped by all the girls present, and another boy is called in. But if he makes a mistake and sits down on the wrong chair, he is lussed so vehemently that he is only too glad to escape from the room. Another player is called in, and the process is repeated, until finally all the boys have guessed correctly.

We all know Touch (Tag), Cat and Rat, Follow-my-leader, Hop-scotch, Hide-and-seek, Twos and Threes, Prisoner's Base, Puss-in-the-corner, Grandmother's Footsteps, and many another simple but energetic outdoor game. In addition, there are all sorts of indoor games to

exercise brain or body, or both, examples being Hunt-the-slipper, Hunt-the-thimble, Up Jenkins, and Blindman's-huff, and, in a different category, Consequences, Noughts and Crosses, and dozens of others. (See also Charades, Draughts, etc.)

Origins of Our Games

Most of the oldest and most popular games did not originate as mere games, but have come down to us as survivals of tragic or comic or exciting events in history. They spread from country to country, with changes of name. In their playgrounds children play games from all over the world, which are often not recognized by the players as foreign games at all, though they may have a history that goes back to the times of ancient Greece.

Poetics, religion, mythology, folktales, folk customs, common occupations, have all given rise to games which have spread from country to country. Hide-and-seek has a most curious origin. It was once the custom among European peasants to go out in the spring and get birds, insects, and flowers to bring back to the village as proof of the approach of the happy season. This seeking for the simple heralds of spring is what the players of Hide-and-seek unconsciously carry out when playing the



A HARD GROUND—BUT GREAT FUN, ALL THE SAME

Who knows what future Cup-tie players may be among this little group of Manchester kiddies playing street football with such zest? The absence of playing fields in dense industrial areas means that the street is the only playground for many boys and girls—a state of affairs for which some sort of compensation has to be found. To allow them to have what little recreation they can get without fear of accidents from traffic, many streets, like the one above, are made forbidden ground to most classes of vehicles from sunrise to sunset.



A MODERN VARIATION OF AN OLD ITALIAN GAME

1 These children are playing "Hit the Pot," much as the game is described in the text, save that they are using a basketball instead of a pot. Any player failing to hit the ball with the object thrown, which may be a stuck pebble, coin, or something similar, must sing dance or pay some other forfeit. In the cruel old days the pot contained a live chicken.

game today. In some countries the hidden players imitate the calls of birds, thus revealing the origin of the game.

"Drop the Handkerchief," also known as "Shpper Slap" and "The Beater Goes Round," is derived from a folk-tale of the Northmen, which relates how Balder, becoming angry with his wife because she talked too freely at a feast of the gods, beat her and commanded her to be silent when men were talking. He further ordered that during the *Julfestivities* (Christmas) this game should be played as a reminder. The young people of Denmark played it when someone came late or made a mistake in a game. He then knelt, hid his face in the lap of Balder and was struck with a knotted handkerchief, to the accompaniment of a rhyme. A similar game was played in 11th century England and at various periods in Europe.

Circle games in which an object is passed around from hand to hand come, it is said, from an old Danish tale. Centuries ago a Danish nobleman, upon going off to war, left a pet bird with a peasant. The bird died and the peasant was severely punished. When the game is played in Denmark today, the players say "I ad ikke min Herre Fugl doe" (Let not my lord's bird die) as the circle of players pass

from hand to hand a lighted paper or bit of wood. While it burns they say "Robin's alive!" The unlucky player in whose hands the fire goes out pays a forfeit.

"Hit the Pot," a blindfold game played in England, Spain, Italy, and Germany, comes from a cruel pastime of a rougher age. In the old days a pot with a hole in the bottom was placed over a chicken whose head protruded. A blindfolded player struck at the poor creature. Today it is played with a pot on a stick, the blindfolded one having three chances to hit the pot.

"Musical Chairs," or "Going to Jerusalem," is known in Germany as "Mauer Blumchen" (Wallflower), and refers to the great loss of life in the Thirty Years' War, which left girls without partners. The game was devised to meet this lack, and was played as today, the leader crying at intervals "Mauer Blumchen" to bring a change of position.

"London Bridge is Falling Down" originated far from London. The ancient Teutons imagined that the dead must pass over a high bridge on their way to the Great Beyond. Over the golden Gjallar bridge warriors went to Valhalla (Heaven), others went over a trembling rotten bridge to the realm of Hel, goddess of death. The guard of each bridge led the people in his direction. When the game is played in Sweden, after the separation of the

CAT'S CRADLE



2 This native of the Fesow Islands takes the string from his toes and twists it into novel designs. In Europe players take the string from each other's hands, changing the design.

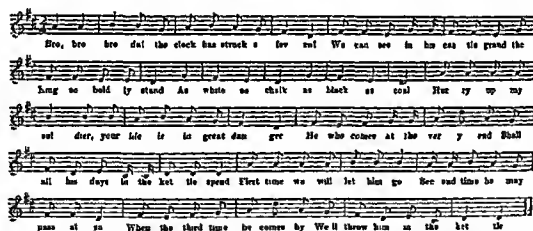


'BRO, BRO, BREDÅ,' A FIGHT BETWEEN GOOD AND EVIL

players into two groups, one guard reveals himself as the devil and hits his partners with the end of a rope. In France the dwellers in Heaven chase and tease the others, putting two fingers to the forehead to denote horns. In Slovenian countries, the two players forming the bridge lift each of the others on joined hands to judge their weight and send them to one side or the other accordingly. In Denmark the game is called "Bro, Bro, Bredå." The French call it "Falling Bridge" or "Heaven and Hell," and sing

Tiens to a passera,
La dernière y restera
(Three times he will pass by,
The third time he will remain.)

In all these countries the game is played in the same way: the two leaders form a bridge with joined and raised hands, and the other players form in a line and march under, singing a song, until the bridge drops on one player. He is given a tantalizing choice between two objects which determines his choice of sides. It ends with a tug of war between the sides.



3. This is a Danish version of "London Bridge is Falling Down." Singing the song shown, the players march under a bridge formed by two of the group. The last player is captured, and, after being offered a tantalizing choice between two objects, joins the army of good or of evil. The game ends in a tug of war between the two sides so formed.

stay in the enemy prison until tagged by one from their own camp, then make their way home without being tagged again.

"Defending the Pass," played in various ways in various countries, comes from the famous defence of the pass of Thermopylae by the 300 Spartan soldiers against the Persians. One way to play it is to draw up two lines of players facing each other. A player approaches from each end and attempts to pass between the lines to the other end. Each row of players tries to stop one of the invaders and drag him to their goal. If he succeeds in getting through the pass, he is given a ride in state by being passed the length of the line on the hands of the players in the facing lines. The losers must assist the winners in fighting at the end

"Prisoner's Base" and "Stealing Sticks" are said to date as far back as the first Olympic games, at which was played a game called "War is Declared." Players selected two camps, with a prison pen in each, and guards over each camp. Scouts would try to penetrate into the enemy's camp. If tagged, they must

of the line. Another arrangement is to seat the players in two rows. They ask questions of the one who is "It" as he passes down the centre. His reply must contain not more than three words. If he succeeds in answering properly he also gets a ride in state. The old military practice of "running the gauntlet" is said to have originated from the defence of Thermopylae.

"How Do You Like Your Neighbour?" is a game played in the Balkan countries and in Turkey. We know it was played in Constantinople as long ago as 1649. The players sit in a circle, and the leader in the centre asks one of them "How do you like your neighbour?" The answer may be "Good" or "No good." If the latter, the player signals another on the opposite side of the circle to change seats with him, and the leader tries to get one of the seats. The player left with out a seat becomes leader.

Many other games come down to us from ancient times. We know from pictures that Egyptian children centuries before the Christian era played a sort of draughts, a dice game, a finger game similar to the Italian "Morra," and various kinds of ball games.



HOP SCOTCH ENTHUSIAST

Don Holmes

Hop scotch is a favourite children's game and is quite simple to play. The only implement required is a flat stone or shell, called the *clapper*. The game can be played on any flat surface that can be marked out into squares, and this ground plan is called the *scotch*. This little child is very intent on her game, many variations of which are possible.

How to Play Twenty-three Foreign Games

1 **Hit the Pot** (picture in page 3285). A basketball is used as a pot, and the players obtain "valuables" in the form of pebbles, sticks, small coins and the like. They form a circle and toss their valuables at the pot in the centre, trying to hit it. Those who miss must pay a forfeit such as a stunt, song, or dance.

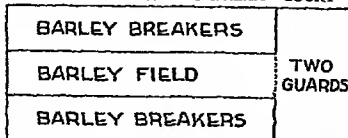
2 **Cat's Cradle** (picture in page 3285). A game found in nearly every land is the childish pastime of playing cat's cradle with a loop of string. The original name in English was "cratch cradle," which in turn comes from the French word *criche* for "cradle." As one player slips the string from the other's hands to his own, he must make it form a new type of "cradle," the number of cradles being limited only by the ingenuity of the players. In some countries bare feet are also brought into play in addition to the hands.

3 **Bro, Bro, Breda** (picture in page 3286). The game is

a variant of "London Bridge is Falling Down." The two players forming the "bridge" are called "The Sun," symbolizing God or the powers of good and "The Moon," symbolizing the Devil, or the powers of evil. The players sing the song in page 3286 as they march in single file under the bridge. At the last word of the song, the bridge drops on a player, who is given a choice by the two leaders. The other players on whom the bridge has not yet dropped withdraw while the leaders ask the newly caught player, "Which would you rather have, a rose or a violet?" or perhaps they offer a choice

between a pearl and a diamond, a silk dress or a gold ring. Considerable imagination may enter into the items selected. The player's decision between the two enticing objects determines on which side of the bridge he will line up. When all the players are caught, the game ends in a tug of war.

DIAGRAM OF 'BARLEY BREAK' COURT



The lively German game of "Barley Break" is played on a court like this, roughly scratched on the ground.

A GROUP OF AMUSING GAMES FULL OF ACTION



4 **Barley Break** A court is scratched on the ground, as shown in the diagram on the previous page. Two guards link arms and face in opposite directions. Two teams of barley breakers run into the central field and taunt the guards, who try to catch them and prevent them from "breaking down the barley," before they return to their own field. Any barley breaker caught must remain standing in the central field until his partner is caught. Then they become guards. Guards can catch the players only in the central field. They cannot enter the two side fields.

5 **Water Sprite** The game resembles "Puss-in-the-Corner." From 10 to 30 players form two lines facing each other, with a large space between representing a river. One player, the Water Sprite, stands in the river and beckons to a player on one bank to cross. This player then signals a player on the opposite bank and they try to exchange places without being caught by the Water Sprite. Anyone caught becomes Water Sprite.

6 **Olympic** The game is derived from the old Greek Olympic games. The players divide into two teams, each team stands in two facing lines, and a basketball is tossed back and forth between the lines of each team for three-minute periods. Any player who lets a ball touch the ground drops out and his



4 The old German game of "Barley Break," which originated in the harvest season. 5 The Chinese game of "Water Sprite," which closely resembles Puss-in-the-Corner. 6 The Greek "Olympic" game. 7 The Scottish singing game of "How Many Miles to Babylon?"

error scores five points for the opposite team. Fifty points constitute a game.

7 **How Many Miles to Babylon?** The game originated in the toll charge paid when entering a city. The players form in two rows, ten feet apart, each couple taking hold of hands. As the rows run forward, one row sings the words "How many miles to Babylon?"

As they dance back, the other row replies, "Three score and ten." They repeat the movement for the next four lines. The song is: How many miles to Babylon?

—Three score and ten
Can I get there by
candle light?

—Yes, and back again.
Open your gates and let
us through!

—Not without a beek and
a boo.

Here's a beek and here's
a boo,

Here's a sou and here's
a sou,

Open your gates and let
us through.

At the words "Here's
a beek," the singers

curtsey, at "Here's a hoo" they bow. With "Here's a sou and here's a sou" they bow and bend the head first to the right, then to the left. Then the partners clasp hands and run forward, taking eight quick steps to the rhythm of the words. Each couple passes under the upraised hands of the opposite couple, then turns around with four running steps. The couple that made the "gates" with their upraised hands then turn around in four running steps and face the first row. The game then begins again.

LIFE OF OLDEN TIMES SUPPLIES GAMES FOR TODAY



8 Widower This game is played in the same way as "Last Couple Out." The players pair off and line up, one couple behind another. The catcher stands at the head of the line, with his back to the players. When he cries "Widower," the last couple at the rear run forward and try to join hands again in front of the line without being touched by the catcher, or "Widower." The player caught becomes catcher.

9 Guard the Blind The Blind Man, "It," is blindfolded in the centre of a circle of players. His guard tries to keep the players from touching him. When he is touched he calls "Stop," and each player must stay in the position he was in at the moment of command. "It" tries to guess the identity of the player who touched him. If he succeeds, the identified player is "It," and if not, the guard becomes "It" and a new guard is chosen.

10 Mount Ball The game is derived from the old Olympic games. Twelve or more players form a double circle, in pairs, one member of each couple standing in front of the other. Then the smaller of each pair climbs on the shoulders of the larger



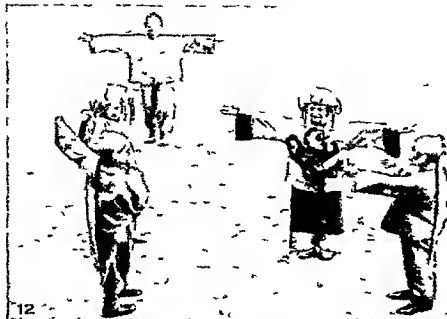
11 The Scottish game of "Widower," which Americans call "Last Couple Out." 9 The Danish game of "Guard the Blind." 10 The Greek "Mount Ball" was played in ancient Egypt. 11 The Italian game of "Follow Chase" is derived from races through Italian archways.

The mounted players toss a basketball back and forth. Any player who drops the ball changes places with the boy on whose shoulders he is sitting. This is not a team game, merely lively exercise and amusement.

11 Follow Chase The players stand in a circle and form arches by putting their arms across each other's shoulders. The chaser pursues a runner in and out of the circle through the arches, retracing the same path as the runner. This game originated at fairs in Italy, where the young people chased each other in and out of the arches of arched galleries.

12 Letting Out the Doves The players divide in groups of three, in which one is "Dove," one "Hawk," and one "Owner." The Owners make the gesture of tossing a dove in the air. The Doves then run a short distance and the Hawks are released. At a signal from the Owners, the Doves seek to return to the Owners uncaught by the Hawks, who, in pursuing, must retrace the route taken by the Doves. Any Dove caught becomes a Hawk, and the successful Hawk then becomes a Dove.

FOUR WAYS OF HAVING FUN AND GOOD EXERCISE



One stone of the wall at a time joins the Fairy until the captive is released, then they all dance around her.

14 Dog Collar The players kneel in two lines, one line on each side of a straight line scratched on the ground, with the heads of each couple of opposing players inside a loop of strong cloth. At a signal, the contestants try to drag each other by the head across

12 The Chinese game of "Letting Out the Doves" 13 Thus do the Danish youngsters play "King King Klona." 14 German backs are strengthened in the curious tussle of "Dog Collar" 15 When the Chinese play "Fruit Sale," it is rather hard on the "fruit" swinging in the basket

13 King King Klona The game is derived from an old fairy tale of a king's daughter who fell in love with a knight, strong and brave, but poor and the son of a peasant. The king imprisoned his daughter in the tower of a castle surrounded by water. There she was to remain seven years, but a good fairy came to release her. The game based on this tale is played in Spain, France, Germany, and Denmark. The players form a circle, each one representing one stone in the wall of the tower. The king's daughter sits in the center with her head covered. Outside the circle stands the Fairy, who sings:

King, King, Klona,
Who sits in the tower (tower)?
The stones of the wall answer

The captive daughter of a king,
That is why we mourn and sing.
The wall will never break,
Her sweet life is at stake

The Fairy sings
Take one stone out
And be busy about



the line marked on the ground. The team dragging the most opponents across the line within one minute wins.

15 Fruit Sale All but two of the players squat, locking their arms around their knees, and thus become "baskets of fruit." The "baskets" try to keep from smiling or unlocking their arms, while two players swing the baskets by the arms and do everything possible to make them laugh or loosen their grip. Any basket which "breaks" or smiles must pay whatever the basket-swingers may require as a forfeit.

16 Charlie Over the Water The game originated during the exile of Charles II of England, "over the water" in France. Ten to thirty players form a circle, Charlie stands in the center in front of a stick placed

GAMES FROM SCOTTISH HISTORY AND JAPANESE ART



16 The Scottish game of "Charlie Over the Water" goes back to the days when exiled King Charles II was urged by the Scots to come back "over the water."



17 The Japanese game of "Japanese Statue" requires muscles to be quick and strong.

to represent a bridge. The players join hands and dance around, reciting in song-song

Charlie over the water
Charlie over the sea
Charlie catch a blackbird
Can't catch me

At the words "Can't catch me," Charlie jumps over the bridge and tries to tag the players before they stoop to the ground. If he succeeds, the tagged player becomes "Charlie." If he fails, he must jump back and forth across the stick as the rhyme is chanted.

17 Japanese Statue, or Tag. The leader calls out a position, such as "Touch left foot," or "Put left elbow on right knee," then quickly shouts "Halt!" The players remain in the position they had reached at the command to halt. Only those who reached the

position required in the first command are allowed to chase the leader.

The one who catches him becomes the new leader.

18 Centepede. From 10 to 20 players sit in a circle with their feet in a promiscuous pile in the center. The leader, with chalk or stick, touches a foot and asks one of the players whose foot it is. If the player guesses wrong, the leader chases him and strikes at him with a knotted handkerchief or folded paper. If the player guesses right, he takes the leader's place, the leader returning to the circle.

19 Schlag Tag. "It" passes around the circle of players, stopping before one. If "It" is a boy, he bows, if a girl she curtsies. After the bow or curtsy, "It" runs pursued by the player of his choice. "It" tries to return to the other's place in the circle before being caught. If touched, he continues to be "It," if not, the other player becomes "It."

20 Crown the King. The game grew out of the dislike of the German peasants for tyrannical kings. The players choose a King, then divide into two groups.

GREEKS AND SWEDES PLAY IN CIRCLE GAMES



18



19

18 When the Greeks play "Centepede," unlucky is he who guesses the wrong set of feet. He is chased and slapped with a handkerchief. 19 In the Swedish "Schlag Tag" the same chasing and slapping ends a game beginning with polite curtsies.

BOYS AND GIRLS OF THREE NATIONS GO OUT TO PLAY



One group forms a wall to guard the King by clasp-
ing each other around the
waist and stooping over
Then the other group, one
at a time, tries to reach
the King by wriggling over
the backs of the guards,
who bounce and sway in
order to shake off the ag-
gressor If he falls off, he
loses If he touches the
King, he scores a point for
his side When all of the
first group have had their
chance to "crown" the
King, the groups change
sides, the guards becom-
ing aggressors and vice versa Or, with fewer players,
each boy may take a turn at crowning the King, and
if he succeeds, he becomes King and the former King
takes his place first in the line guarding the King

21 Forcing the
City Gates Players
lock hands in two
lines facing each
other, each line hav-
ing a captain One
captain chooses a
player to advance
against the opposite
side and try to force
his way between two
players If he pushes
their hands apart,
he takes them over to
his side If not, he
remains on their
side Captains alter-
nate in sending out
"gate breakers" and
the side wins which
finally gets all of the
players away from
the opposing side



20 Thus do the Germans "Crown the King," with much turmoil
among the revolutionary faction 21 It takes strong arms to
play this Chinese game of "Forcing the City Gates" 22 The
Swedish game of "Stealing the Bone" begins with a lively song
and ends with Doggie Doan chasing the thief

22 Stealing the Bone
"It" squirts in the centre
of a circle of players and
covers his eyes A small
object, the "bone," lies
behind him The players
dance around in a circle
singing

Doggie, Doggie Doan,
You'd better guard the bone,
For I will snatch and run
away

And keep it for my own

At the last word, the
player nearest the "bone"
snatches it and runs out-
side the circle, Doggie
Doan in hot pursuit If

the snatcher returns to his place in the circle before
Doggie Doan, or "It," can catch him, the same
player continues to be Doggie Doan But if Doggie
Doan succeeds in tagging the snatcher and recover-

ing his bone, the
snatcher then becom-
es "It" and the
game continues

23 Crab Race
The players sit on
the ground, then
prop themselves up
on hands and feet,
with back to the
ground In this in-
convenient position
they race backward
like crabs A goal
line is marked on the
ground The race
may be run in relays
if there are many
players, or it may be
an individual scram-
ble, won by the
girl or the boy
who laughs least.

IT'S A GOOD TRICK, ESPECIALLY IN KIMONOS



The Japanese national costume, the kimono, is no help at all in running a
"crab race" Neither is the laughter which shortens your wind as you try this
ridiculous, upside-down, backward race on all fours

PLEIADES

Pleiades. (Prou ph' a dē) The group of five stars known as the Pleiades were once, according to Greek mythology, the seven daughters of the Titan Atlas. According to one story, they killed themselves from grief at the fate of Atlas, their father, who was compelled to bear the weight of the heavens on his shoulders. According to another, they were companions of Artemis (Diana), and were rescued from the hunter Orion by the gods and set aloft in the sky. Only six of the stars are easily visible. The seventh, called "the lost Pleiad," was said to hide herself for shame because she had married a mortal. There are about 100 fainter stars in the group, which forms part of the constellation Taurus (the Bull).

Plough. When the plough developed from the crooked stick and crude wooden affair of primitive days to the modern well-planned steel tool, more land could be ploughed and larger and better crops raised, for proper preparation of the soil is a basic condition of good agriculture.

Ploughs are of many different kinds. There is the walking plough, which the ploughman holds in position by gripping the curved handles. The riding plough is a plough with wheels and a seat for the driver. The multiple or gang plough has two or more bottoms, and turns a number of furrows at once; this type may be used either with horses or with tractors. Ploughs are adapted to various purposes by the shape of the plough bottom and the angle at which it is set on the frame. The parts of the plough bottom are the sharp pointed *share*, which is directed into the ground and cuts the bottom of the furrow, the *mould board*, which turns the furrow, and the *landside* or flat side, which takes the side pressure and helps in guiding the plough. A *coulter* is often used to cut the sod ahead of the mould-board. The disk plough utilizes rotating steel disks set at an angle to the furrow, instead of a ploughshare, to cut the soil. (See also Agriculture.)

Plover. (Pron pluv' er) If you live in open country, moorland or agricultural, you will know the green plover or lapwing (*Vanellus vulgaris*). Its cry, "pee wit," which it utters whenever you approach the nest or the young birds, or when it is in any other way disturbed, is responsible for another of its names

POLOVER

On the wing the lapwing is easy to recognize, for its wings are curiously long and rounded, while the bird seems all black and white when in the air. Yet, seen on the ground, it is a most handsome bird, bluish green with a metallic lustre, and has a long crest. The lapwings look after their little ones very carefully. If the old birds see anybody coming they often pretend they are wounded, to divert attention from the baby birds, who thus have a chance to scurry into safety among the bushes. But you will be lucky if you find the nest, for this is just a "scrape" on the ground, in which are laid the four pear shaped eggs, the points always directed inwards. They are mottled with dark brownish on a ground which varies from green



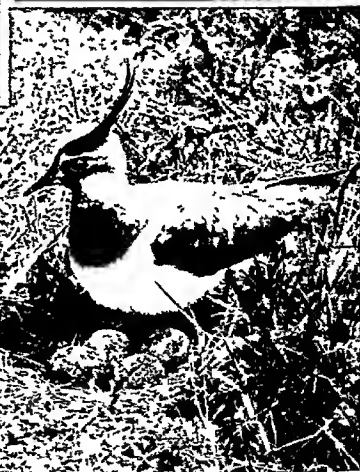
PLOUGHING 'THE STUBBORN GLEBE'

H. R. Hillsworth

Here is a sight to be seen the whole world over, though the motive power may range from oxen to tractor. From the Hampshire lowlands, seen above, to the great plains of Canada the plough is needed to break up the soil before sowing. The one shown here is a typical English walking plough, guided with handles by a skilled ploughman.

to brown, according to whether the site is on green pasture or brown moorland. The eggs are very difficult to distinguish from their surroundings, and, when disturbed from the nest, the bird runs quickly for some distance before taking to the air, thus further deceiving you. Plover's eggs, a great delicacy, are no longer allowed to be used for food.

Other plovers that are found in Britain include the beautiful golden plover (*Charadrius plumalis*), which nests principally in Norway, Russia, and Siberia, as well as in the north of Britain. It is about 11 inches long and is blackish with yellow spots. Golden plovers are strong on the wing, the flocks flying in the form of a wedge; they are also fast runners and



PLOVERS, GOLDEN AND GREEN

Here are three representatives of our plovers. Above is a golden plover approaching its nest in the moorland grasses, top right is a young plover sitting on the hand of its captor, and, below on the right, is a green plover settling on her four eggs.

Photos: top left, H. J. Forsyth; right, A. S. Martin; bottom, T. M. Thomson.

walkers. British, too, are the ringed plover (*Actitis macularia*), with a black and white ring round its neck, which is fairly common along the coasts, the grey plover (*Squatarola helvetica*), which is a winter visitor to this country and is very much like the golden plover, except that it has no yellow spots, and the Kentish plover (*A. alaudina*), from 6 to 7 inches long, with a white collar and dark mark on each side of the breast, which used to breed on the shores of Kent and other English counties, but it is now nearly extinct.

The plovers, built for long-distance migration flights as well as for fast running and even for swimming, are typical of the great order, *Charadriiformes*, to which all the "waders" belong, including snipe, curlew, redshank and sandpipers, etc. All these birds nest on the bare ground, and all are fine fliers. A type of American golden plover is thought to fly from Alaska to Hawaii, some 2,000 miles, non stop.

Plum. Ranging in size from that of a cherry to that of a hen's egg, coloured purple or dark blue, red, yellow, and green, plums are a common and popular fruit. The plum of our orchards and gardens is believed to have originated from the ordinary wild plum (*Prunus domestica*), which is a native of Asia Minor and the

Caucasus, or from the bullace (*P. insititia*), which grows wild in parts of Britain. These are both very closely related to our wild sloe or blackthorn. Many of the cultivated plums are grafted on stocks of the wild plum.

Among plums are included the damson, a small oval purple plum, the greengage, with very rich flavour, and the egg plums. Prunes, French plums, and Elvas plums are names given to certain varieties of plums which have been dried whole. A distinct variety of plum is the Cashmere plum, grown in Kashmir and Bokhara. The dried-plum industry is carried

on in various parts of southern Europe and in the U S A In Britain, the vale of Evesham in Gloucestershire is the great plum-growing district, but in recent years there has been much distress and many growers cannot sell their plums at a profitable rate (See Prunes)

Plutarch. (Pron plo'-tark) (c A D 46-120) Few historians of ancient times are more widely read or have had a greater influence than this keen-witted but toroidal essayist and biographer Plutarch's "Lives" has been called "the food of great souls," because of the wealth of wisdom it contains, and it formed the inexhaustible storehouse of fascinating stories from which Shakespeare drew most of the characters and incidents of his classical plays

Plutarch was not a critical historian He was interested primarily in character, and so he blended fact and legend into a tangle which only modern scholarship has been able to unravel But, despite this defect, his biographies remain one of the foremost sources of information about classical antiquity Young and old for centuries have delighted in reading them for their enthralling incidents and their masterly sketches of character

The "Parallel Lives of Illustrious Greeks and Romans" are written mostly in pairs (one Greek and one Roman each), and they contrast such men as Demosthenes and Cicero, Alexander and Caesar, Pericles and Fabius Besides these, Plutarch wrote about 60 essays, known as the "Opera Moralia," discussing such subjects as "The Education of Children," and "How to Get Benefit out of Enemies"

Plutarch was born at Chaeronea in Boeotia, a district of Greece He was educated in philosophy at Athens, and spent several



RIPE AND LUSCIOUS PLUMS

The plum is a great favourite among summer dessert fruits, and equally popular, in its many varieties, for stewing and for making into tarts or jam This spray shows some fine early eating plums, ready for plucking

infernal regions, the last fell to Hades Here he ruled with his wife Persephone over the dead and over the other powers below

The name Pluto was also given to the new planet discovered in 1930 Here is the planet's story The existence of another planet was sus-

pected because it produced irregularities in the motion of Neptune, just as Neptune did in the motion of Uranus, but, as it was so much farther away, its detection took longer Close to the place in the skies where Dr Percival Lowell had predicted its presence, his successors of the Lowell Observatory at Flagstaff, Arizona, U S A, after an unflinching search of, 15 years, sighted a faint spot in the heavens and proved it to be the ninth planet

Proof of Pluto's existence was first provided by a photograph made on January 21, 1930, by Clyde Tombaugh Since then many astronomers have observed and studied it One revolution of Pluto in its orbit requires about 248 years It is about 3,680 million miles from the sun But its orbit is so elliptical that, although it is now 1,000 million miles



PLUTO AND PERSEPHONE

This statue by Bernini in the Borghese Museum, Rome is of Pluto the god of the underworld carrying off Persephone as she is gathering flowers at Enna in Sicily Behind him is the dog Cerberus, grim guardian of the underworld

PLYMOUTH

farther from the sun than Neptune, in 1988 it will be only 63 million miles beyond. It weighs about seven times as much as the earth. A man who weighs 11 stone on the earth would weigh about $22\frac{1}{2}$ stone on Pluto. (See also Planets)

Plymouth. From the decks of an ocean liner at anchor in the harbour of Plymouth, the westernmost of England's Atlantic seaports, one sees at once why England has been likened to a great garden. Behind the city patches of darker green woods alternate with the paler shades of growing crops.

The city of Plymouth, within these encircling rounded knolls of Devonshire, includes Devonport (the naval base) and Stonehouse, and is situated on the west bank of the river



NAVAL MEMORIALS AT PLYMOUTH

On Plymouth Hoe stand three monuments to England's sailors. In the centre foreground is the Armada monument, to the right is the new Naval War Memorial, and in the distance, on the left, is the statue to Sir Francis Drake. It was on the Hoe that Drake was playing his famous game of bowls when the Armada approached.

Plymouth Hoe, which was begun by Henry VIII, at the head of Plymouth Sound—with its inlets the Cattewater, Sutton Pool, Mill Bay, and the Hamoaze—stands a striking monument to Sir Francis Drake, and hereabouts is the laboratory of the Marine Biological Association.

The ridge that extends between Sutton Pool and Mill Bay is called the Hoe. Plymouth supplied seven of the ships which struggled against the Spanish Armada, and it was in the Sound that the English fleet, commanded by Drake, who had been playing bowls on the Hoe, awaited the coming of the Spaniards. On the Hoe is the old Eddystone lighthouse. (See Eddystone) On the north-east side of the Citadel is the Mayflower commemoration stone, which records the fact that this was the last

PNEUMATIC

port touched by the Pilgrim Fathers on their way to America. (See illustration in page 3251)

Plymouth today is an important commercial port, naval station, and seaplane base, and many transatlantic liners put in there to discharge passengers and cargo for London. The sect known as the Plymouth Brethren, founded by the Rev J N Darby, originated in Plymouth in 1830. The population of the city today is about 208,000.

Pneumatic Appliances. "As light as air" is a saying which expresses the every day opinion about the substance we breathe. But when this seemingly weightless substance is compressed, it exerts tremendous power. So, also, if it is exhausted from an enclosed space, the inrush of other air to fill the vacuum is

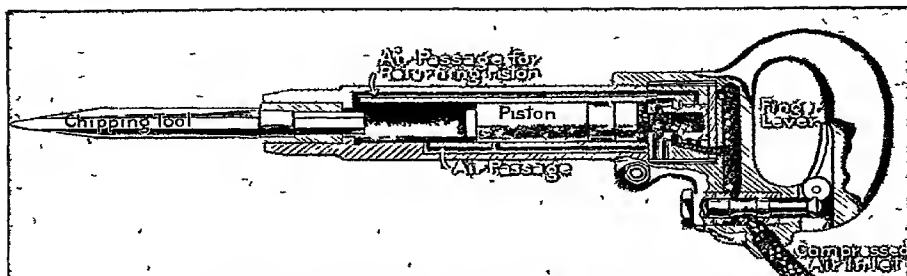
powerful. (See Vacuum) These two sorts of power have been applied to a variety of useful tasks.

If you take a long brass tube and connect an air pump so that the air is continually being exhausted from it, the air will rush in violently when either end is opened. Suppose, now, you open one end and slip in a small brass cylinder, with felt round its ends to make it fit the tube. The pressure of air trying to get in the tube from behind will shoot the cylinder along the tube, and by placing the other end at any desired point you can make the arrangement deliver the cylinder anywhere you want. A trap-door at the other end

will let the cylinder shoot out, and shut quickly enough to keep air from filling the vacuum.

Compressed air may be used to drive the carrier cylinder along, instead of a vacuum to draw it. Both systems are largely used to transmit money in shops, letters in post offices, messages in banks, "copy" from department to department of newspaper offices, and, in some countries, under streets, from news distributing agencies to the different news papers in the town. In a three inch tube a loaded carrier will travel 1,000 yards a minute under a 10 lb pressure, and the speed on other tubes varies according to the size of the tube, the weight of the load, and pressure used.

If you blow across the surface of a dish of water, you know that a quantity of water is carried off in fine spray. This principle is used



THESE HAMMERS AVERAGE 1,600 BLOWS A MINUTE

This sectional view of the air hammer shown in the picture below explains its operating mechanism. Slight pressure on the finger lever, on the right, lets compressed air into the chamber behind the piston. This forces the piston sharply against the chipping tool. In the meantime, the position of the valves in the rear is automatically changed so that air is forced through the upper passage to drive the piston back. Another valve in the main chamber, behind the piston, allows the air to escape. The operation is repeated so rapidly that the blows sound like shots from a machine-gun.

in instruments for spraying liquids. A blast of compressed air crosses the substance to be sprayed, and a nozzle directs the spray. Paint and cement are often applied to surfaces in this way, and the "sand blast" is used to direct a stream of sand against the sides of buildings to scour off grime and dirt. Artists use a similar device called an "air brush" to "retouch" pictures.

Compressed air is also used to drive pistons in cylinders, just as steam is in the steam-engine. The pneumatic hammer and pneumatic presses and drills are examples of this use of air. In hammers the compressed air is applied to each side of a piston in turn, and some types will deliver as many as 2,000 blows a minute. In pneumatic presses the air is applied to a plunger, while other devices employ small motors geared to the working tool. Compressed air locomotives are often used in mines, ammunition factories, and other places where steam or electric locomotives would be dangerous or undesirable. Compressed air is also used as a cushion, cycle and motor tires being important examples.

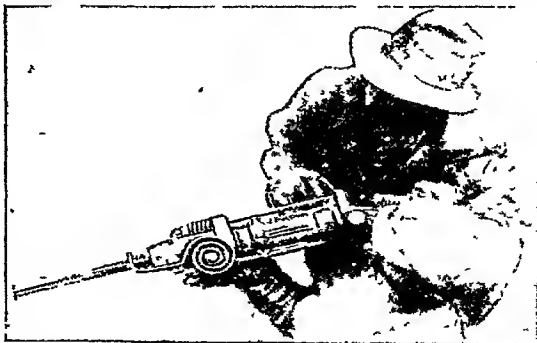
If compressed air is driven into a water-filled tunnel or an inverted cup-like chamber under water, the pressure of the air will keep the water out, and provide a space in which men can work. Compressed air is largely used in this way in driving foundations and tunnels through watery soil, under rivers, and in making foundations for structures like lighthouses and bridges.

The general principles concerning the behaviour of gases like air when

compressed, reduced in pressure, or flowing about in response to various forces, make up a branch of physics which is known as pneumatics.

PO, RIVER. Rising high in the Cottian Alps on the extreme western border, Italy's largest river is a mountain torrent in the first stage of its 420 mile course to the sea, and falls more than 5,200 feet in only 21 miles. Fed by the snows of the Alps, and by tributary streams, it widens to 425 feet as it nears the busy city of Turin and moves more slowly. At last, winding sluggishly across Lombardy, it finds its way round its huge delta into the Adriatic.

With fine sediment that the river carries from the Alps and from the Apennines, it increases the area of its delta about 175 acres every year, so that some towns once on the coast are now



COMPRESSED AIR WRECKS A BUILDING

Here we see two men using the versatile air hammer, equipped with a drill to tear down the solid brick walls of an old building. This tool is most often used by workmen who are cutting through roadways to lay new pipes.

several miles inland. It also keeps raising its bed, which is in many places above the level of the surrounding country. The resulting floods often prove disastrous.

Because of the Po's great volume and width it is a hard river to cross, and its commercial cities such as Piacenza and Turin are found where there are the easiest fords. It teems with salmon, shad, sturgeon, and other fish.

Poe, EDGAR ALLAN (1809-1849) In the annals of literature there is no more dark and disastrous career than that of this American poet and story writer, whose inherent faults of character and lack of training combined to quench in early death a truly fine and original genius.

From his mother, an English actress, and his father, a stage-struck youth of the American city of Baltimore, who left him an orphan in infancy, Poe inherited a highly nervous and emotional temperament, which needed the kindest and wisest oversight. Instead, the handsome, precocious boy, alternately indulged and treated with severity, was brought up as the spoiled heir to the fortune of a wealthy godfather, who at length, tired of Poe's insubordination and bad habits, proceeded to disown him.

A man of striking personal appearance, charming manners, and obvious gifts, Poe then discovered he had a talent for writing and soon secured positions on the leading magazines of the day. But his weakness of will and occasional dissipations made him unreliable and kept him in poverty. Yet in intervals of deadening hackwork he wrote short stories and verse which are among the most precious of American classics.

In poetry his genius was unique. He makes no appeal to the intellect, but, as a result sometimes of his own morbid state of mind, expresses a melancholy, sensuous emotion in verse, whose

perfection of melody suggests fine musical compositions. His prose stories, too, have a strange fascination. He gives form to horror and fear, or constructs and unravels mysteries with fidelity to scientific principles. He was the pioneer of the modern detective story.

The publication of "The Raven" in 1845 made him the literary lion of the day, but good was followed by ill fortune. He had married his beautiful cousin, Virginia Clemm, the "sainted maiden" of "The Raven." Two years after the

appearance of this famous poem his idolized young wife died after a long decline and amid the tragic privations of poverty. Grief and remorse Poe made a heroic effort to conquer his weakness, but he died wretchedly in a Baltimore hospital.

Poet Laureate.

As the laurel tree, in ancient Greece, was considered sacred to the god Apollo, patron of poets, the custom arose of crowning poets who had won distinction with a wreath of laurel. Later the same practice was followed in Italy, where Petrarch and Tasso received this honour. In time the word "laureate," which meant originally "crowned with laurel," came to mean honoured or eminent, or associated with glory.

The title "Poet Laureate" is given in England to the poet attached to the Royal Household. From very early times it was the custom of the English kings to include poets or minstrels in their retinue. Instead of being crowned, however, they were granted pensions as a mark of royal favour. Such a pension, together with a pitcher of wine daily, was granted to Chaucer in the 14th century, and Spenser in the 16th century was honoured in a similar manner by Queen Elizabeth.

Ben Jonson (1573-1637) was probably the first to hold a regular office as court poet, and he was



POE WORKS WHILE PUSS LOOKS ON

Edgar Allan Poe did much of his youthful work at night in the simple living-room of the cottage in which he lived with his aunt. At the plain deal table he would conjure up his wonderful tales of imagination while his pet cat, Catalina, sat on his shoulder.

succeeded by Sir William Davenant in 1638 John Dryden, who held the office from 1670 to 1689, was, so far as is known, the first to receive the official title of Poet Laureate. Nowadays the Poet Laureate receives a small annual allowance, foregoing the traditional "butt of sack."

Dryden's successors, with their terms of office, are Thomas Shadwell (1689-92), Nahum Tate

(1692-1715), Nicholas Rowe (1715-18), Laurence Eusden (1718-30), Colley Cibber (1730-57), William Whitehead (1757-85), Thomas Warton (1785-90), Henry James Pye (1790-1813), Robert Southey (1813-43), William Wordsworth (1843-50), Tennyson (1830-92), Alfred Austin (1896-1913), Robert Bridges (1913-30) and John Masefield

The POET'S MAGIC ART of WORD-MUSIC

In all art the aim is to capture a mood and pass it on unchanged to the listener, reader, or beholder. How everyday words can be given this magic life by the poet is told here

Poetry. We do not know who the first person was who had the idea of telling a story or expressing a thought in rhyme, chanting words with a strong and easily remembered beat. Perhaps he thumped a wooden drum by some very early camp fire and, as he thought of his day's hunting or the fearfulness of the night or his own bravery, began to fit words to the rough tune. He would chant and stamp and beat as he made those words. Where the words did not fill out the tune, he would give a shout or a cry. That must have been the earliest and most primitive form of poetry—rhythmic words, chanted aloud to a rough musical accompaniment or to no accompaniment at all but the stamp of the chanter's feet on the ground.

It is a long way from the chanting singer in the red light of the camp fire to the printed book of verse in your library. But the road is a clear one, and the poet's intent the same. He is trying to tell you something—perhaps a story about gods or heroes, or about the people you meet every day—perhaps merely about his own feelings when he sees a cloud or a flower—perhaps about the mysterious things of life, the things like death and birth and the great empty places between the stars which make us feel small and wondering when we stand before them. But he is trying to tell it to you rhythmically, in musical words that will stir your imagination and leave a magic pattern on your mind. He wants to make you see what he has seen and feel what he has felt. To do so, he uses words not only for their meaning but for their ring and music.

What tools does the poet use to make his rhythmic pattern, the pattern with which he hopes to stir your imagination? He has three chief tools—rhyme, metre, and pattern. He uses them in various combinations.

Let us start with the simplest, the one most familiar to us—rhyme. What is a rhyme? A rhyme is a pair of words which end with the same sound but begin differently.

Hickory dickory dock.

The mouse ran up the clock.

Dock and clock are rhymes. So are Mary and contrary, Horner and corner, pail, whale, and sail

and thousands more. But *soar* and *sore* are not rhymes. They are spelt differently, but the sound is identical, both the beginning and end sounds are the same.

In words of more than one syllable, the rhyme must be where the emphasis is. Thus *ailing* and *failing* are rhymes, because the emphasis on each word is on *ail* and *fail*. But *ailing* and *thing* are not true rhymes, as the emphasis in *ailing* is on the *ail* sound and the emphasis in *thing* is on the *ing* sound. Rhymes consisting of a stressed followed by an unstressed syllable (like *ailing* and *failing*) are called "feminine", in "masculine" rhymes only the last syllable rhymes (*amend* and *pretend*).

In general, the person who is beginning to write poetry should try to make his rhymes as clear and true as possible, if he writes in rhymed form. For rhymes are the bolts of English verse, and there are rhymes of every sound and every metal. You can set a whole peal ringing at once, as Poe did in "The Bells" or as Southey did in "How the Waters Come Down at Ledore."

Advancing and prancing and glancing and dincing
And dashing and flashing and splashing and chancing
You can ring them against each other, single
rhymes against double rhymes.

So we'll go no more a'roving,

So late into the night,

Though the heart be still as loving

And the moon be still as bright

You can play tricks with them, as W. S. Gilbert did in his patter songs.

From the greengrocer's tree you get grapes and green pea
cauliflowers, pine apple and cranberries,
While the pasky cook plant, cherry brandy will grant,
apple puffs and three corners and bunsbury's.

You can use very simple rhymes, as A. E. Housman does in his perfect

Lowliest of trees, the cherry now

Is hung with bloom along the bough

And stands about the woodland ride

Wearing white for Easter tide

Now, of my three score years and ten

Twenty will not come again,

And take from seventy springs a score

It only leaves me fifty more

And since to look at things in bloom

Fifty springs are little room,

About the woodlands I will go

To see the cherry hung with snow

POETRY

You can use rather odd ones, as Browning often does

I the Trinity illustrate
Drinking watered orange-pulp,
With three sips the Arrian frustrate
While he drains his at one gulp

But, whatever your mood, you will generally find a rhyme to suit it For the English language is rich in rhymes

How Metre Rules Great Verse

Metre comes from the Greek *metron* (measure) and is the measured rhythm of a line of verse The simplest way to define a metre is to call it a series of lines of verse in which each line has the same number of strong beats—places where the voice of the reader stresses a word or a syllable of a word

"Hickory dickory dock" As you read it, you say "HICKory DICKory DOCK" Your voice makes the stresses automatically It is just like a fist tapping a punch-ball three times "HICK" and the ball flies away, "DICK," and you strike it as it returns, "DOCK" and the ball flies away for the last time And when you read the next line, you do the same thing "The MOUSE ran UP the CLOCK" Three more taps on the punch-ball And then, for variety's sake, the metre changes "The CLOCK struck ONE, the MOUSE ran DOWN" Only two taps apiece to the line this time Then a return to the first three-tap metre "HICKory DICKory DOCK"

The three-tap metre is called *trimeter*, the two-tap metre *dimeter* *Tetrameter* is four-tap metre, *pentameter* five-tap, and so on, from a metre as short as the *monometer* (one-tap) to the long *hexameter* (six-tap) It is a wide range, a wide and varied keyboard

The stressed and unstressed syllables are rather like the dots and dashes in the Morse telegraphic code In scanning poetry—that is, in analysing it for its rhythm—they are usually represented by the following signs

◡=dot=short syllable, unstressed by the voice

—=dash=long syllable, stressed by the voice
The syllables are not really long or short in themselves, it is the stress of the voice that counts *Feet* are made up of combinations of stressed and unstressed syllables Some of these combinations, or kinds of feet, are

— = spondee
◡ ◡ = iambus ◡ ◡ = anapest ◡ ◡ ◡ = amphibrach
— ◡ = trochee — ◡ ◡ = dactyl — ◡ = amphi-macer

Perhaps the easiest way to remember them is from this verse of S. T. Coleridge's

Trochee trips from long to short,
From long to long in solemn sort,
Slow Spondee stalks, a strong foot! yet ill able
Ever to come up with Dactyl's treacherable
Iambus march from short to long—
With a leap and a bound the swift Anapaests throng

One syllable long, with one short at each side,
Amphibrach hastes with a stately stride —
First and last being long, middle short, Amphimacer
Strikes his thundering heels like a proud high-bred racer

Suppose we take two lines and scan them

John Gilpin was a citizen
Of credit and renown

Read it and see where the strong stresses are

John GILpin WAS a CIT-i-ZEN
Of CREDIT AND reNOWn

Then divide it into feet and mark the long and short syllables

John GILpin was a cit-iz-en
Of cred-it and re-noun

The first line is iambic tetrameter, the second iambic trimeter But listen to the beat of the anapaests in

I gal-loped, Dick-gal-loped, we gal-loped all three
Here is tetrameter too, but a strongly anapaestic tetrameter, making for a much longer line and a differing rhythm

The great Greek metre was the *hepameter* (six-foot), the metre of the Iliad and the Odyssey It has never acclimatized itself very well in English, though we have an example in Longfellow's "Evangeline"

This is the forest pri-maeval, the murmur-ing
pines and the hemlocks

The metre holding a similar position in English, the metre of Shakespeare's plays and Milton's "Paradise Lost," is the iambic pentameter (short-long, five feet metre) When it is unrhymed we give it a name of its own and call it *blank verse* Here is Shakespeare

Once more into the breach, dear friends, once more
Or close the wall up with our English dead

and again

The singing masons building roofs of gold
and again

Tomorrow and tomorrow and tomorrow
Creeps in this petty pace from day to day
To the last syllable of recorded time,
And all our yesterdays have lighted fools
The way to dusty death Out, out, brief candle!
Life's but a walking shadow, a poor player
That struts and frets his hour upon the stage
And then is heard no more

Here is Milton

Of Man's first disobedience and the fruit
Of that forbidden tree whose mortal taste
Brought Death into the world and all our woe
Sing, Heavenly Muse,

and again

Thick as autumnal leaves that strew the brooks
Of Velloimbrosa,

All very different, all wonderfully varied, yet all using the same basic structure

Patterns in Poetry

There are certain set patterns in poetry as there are certain regular metres For convenience in discussing rhyme schemes we indicate identical rhymes by the same letter A *couplet* consists of two lines of verse rhyming *aa*, a *quatrain* of four lines, rhyming variously "We'll go no more a-roving" (quoted above) is a

quatrain The heroic couplet is two rhymed lines of verse in iambic pentameter Alexander Pope wrote largely in the heroic couplet and made it as trim and telling as the sting of a bee

A little learning is a dangerous thing
Drink deep, or taste not the Pierian spring

The Spenserian stanza is named after Edmund Spenser, who wrote the "Faerie Queene" It is a form, often used to tell a story, in which each separate stanza consists of eight lines of iambic pentameter, rhyming *ababbc*, and a line of iambic hexameter at the end, rhyming *c* Thus hexameter line is called an *Alexandrine* The following example of a Spenserian stanza comes from Byron

Roll on, thou deep and dark blue Ocean—
roll!

Ten thousand fleets sweep over thee in
vain

Man marks the earth with ruin—his control
Stops with the shore upon the watery
plain

This wrecks are all thy deed, nor doth
remain

A shadow of man's ravage, save his own,
When for a moment, like a drop of rain,

He sinks into thy depths with bubbling
groan,

Without a grave, unknelled, uncoffined,
and unknown!

Perhaps the most famous of the set patterns in English poetry is the sonnet It must consist of fourteen lines of iambic pentameter, rhymed usually in one of two ways Here is a sonnet on the sonnet itself, by the American poet, Richard Watson Gilder

What is a sonnet? 'Tis the pearly shell
That murmurs of the far off murmuring
sea;

A precious jewel carved most curiously,
It is a little picture printed well

What is a sonnet? 'Tis the tear that fell
From a great poet's hidden ecstasy,

A two edged sword, a star, a song—ah me!
Sometimes a heavy tolling funeral bell

Thus was the flame that shook with Dante's breath
The solemn organ whereon Milton played

And the clear glass where Shakespeare's shadow falls,
A sea thus is—here are who venture!

For like a flood the narrow floor is laid
Mid ocean deep sheer to the mountain walls

This sort of sonnet, rhyming *abbaabba cdecde*, we call a Petrarchan or Italian sonnet, from Petrarch, the great Italian poet The other customary form of the sonnet, consisting of four quatrains with an ending couplet (*abab cdcd efef gg*), we call a Shakespearean sonnet Here is one of the great Shakespearean sonnets Notice the difference in rhyme scheme

Shall I compare thee to a Summer's day?
Thou art more lovely and more temperate

Rough winds do shake the darling buds of May
And Summer's lease hath all too short a date



POETS' CORNER AT WESTMINSTER

Famous throughout the English-speaking world is the corner of the south transept of Westminster Abbey, which is known as Poets' Corner because it is filled with memorials to many of our greatest writers and poets Though only a few are buried here, Chaucer being among the number, many others are commemorated by busts and plaques, including Shakespeare, Ben Jonson, Milton, Spenser, and Dryden

(Note the 5 Couplet)

Sometime too hot the eye of Heaven shines
And often is his gold complexion dimm'd
And every fair from fair sometime declines,
By chance, or nature's changing course, untrimm'd
But thy eternal Summer shall not fade
Nor lose possession of that fair thou ow'st,
Nor shall Death brag thou wander'st in his shade
When in eternal lines to time thou grow'st
So long as men can breathe, or eyes can see,
So long lives this, and thus gives life to thee

Certain other forms, chiefly those borrowed from the French (the *ballade*, *villanelle*, *rondeau*, and so on), are also strict patterns Outside these forms, the poet makes his own pattern He may write a poem as long as "Paradise Lost" entirely in one metre, blank verse He may write as Shelley did in "To A Skylark"

Hail to thee, blithe spirit!

Bird thou never wert,

That from heaven or near it,

Pourest thy full heart

In profuse strains of unpremeditated art

Here the pattern in each stanza makes use of more than one metre, more than one sort of



THE WHITE WINDOW

The moon comes every night to peep
Through the window where I lie,
And I pretend to be asleep,
But I watch the moon as it goes by,
And it never makes a sound

It stands and stares, and then it goes
To the house that's next to me,
Stealing on its tippy toes,
To peep at folk asleep maybe.
And it never makes a sound



LYRICS FOR LITTLE FOLK

This charming little rhyme-sheet with its delightful decorations by Philip Hagreen, is one of many such published by the Poetry Bookshop, and is just the thing to hang on the nursery wall. The verses are by James Stephens, the Irish poet. By permission of Messrs Macmillan & Co and Mrs Harold Monro.

rhyme, and plays long lines against shorter ones. But once the form is established that form is followed throughout the poem. The poet may write, as Matthew Arnold does in "Phloemela,"

Hark! ah, the nightingale!
The tawn! throated!
Hark! I from that moonlit cedar what n burst!
What triumph! bark! what pain!

Here the metre is irregular, and the verse unrhymed, it is the rhythmic pattern of the poem

which makes the music. In fact, once the poet knows his business, he may do as he pleases, except in the strict forms. He may write in free verse, blank verse, rhymed verse, regular metres, irregular metres. But he must suit your imagination and do it in a way that is not the way of prose. If he writes

At 10 85
Mr John W Higgins
Went down to the baker's shop
To get n loaf of bread

he is not writing poetry but chopping up a piece of prose and arranging it in lines. If he writes, as Walt Whitman did

As toilsome I wandered Virginia's woods,
To the music of rustling leaves kicked up by my feet (for 'twas autumn)
I marked at the foot of a tree the grave of a soldier,
Mortally wounded he and buried on the retreat (even all I could understand)
The halt of a mid-day hour when up I no time to lose— yet this sign left.
On a tablet scrawled and nailed on the tree by the grave
Bold, cautious, true and my loving comrade
Long, long I muse, then on my way go wandering,
Many a changeful season to follow and many a scene of life,
Yet at times through changeful season and scene, abrupt alone or in the crowded street,
Comes before me the unknown soldier's grave, comes the inscription rude in Virginia's woods,
Bold, cautious, true and my loving comrade

he is writing poetry, though pattern and metre are irregular and there is no rhyme. But there is a music in the pattern, and the poem says more than its words. It is not told in the way of prose.

This proves that rhyme and metre are not essential to good poetry, and the opposite also holds true: that keeping to hard and fast rules of prosody will not necessarily produce poetry. A famous example of this is a couplet by Wordsworth, who, writing of a pond he had found, says

I measured it from side to side,
Two'n three feet long and two feet wide
Dr Johnson burlesqued such pedestrian verse
in these famous lines

I put my hat upon my head
And went into the Strand
And there I met another man
With his hat in his hand

The Various Kinds of Poetry

There are kinds of poetry as there are kinds of metres. A lyric is a brief, intense burst of music in words—"Where the bee sucks, there suck I," "With rue my heart is laden," "Come unto these yellow sands." It must mount into the air or it is nothing. A poem 250 lines long, though it might have lyric qualities, would not be a lyric. Lyric poetry is singing poetry.

Elegiac poetry grieves for a dead friend. Gray's "Elegy in a Country Churchyard," Milton's "Lycidas" and Tennyson's "In Memoriam" are elegies. An ode usually deals with an exalted or impersonal subject in a somewhat formal pattern, e.g., Keats' "Ode to a Grecian Urn"

Narrative poetry tells a story. *Epic* poetry is poetry dealing with heroic subjects in a heroic manner. A *ballad* is direct and simple, a swinging tune about war or love or stirring events—"The Bonny Earl of Murray" is a ballad, so, too, is "Lord Ullin's Daughter."

Dramatic poetry builds a drama or play, Shakespeare's plays are the best examples of dramatic poetry, in English. *Didactic* poetry is intended to teach a lesson or to point a moral, Pope's "Essay on Criticism" is of this type.

How can we appreciate poetry? We must train our ear for it, as we train our ear in music to appreciate counterpoint and harmony. We can do so best by remembering, first of all, that poetry is meant to be heard as well as read. If a passage or a poem seems unmelodious to you at first, read it over to yourself, aloud or half aloud, feeling for the music and the pattern that were in the poet's mind. If, in modern poetry, certain words and phrases seem to you "unpoetic," remember that poetry is made from live words, current words, not dead ones. It must have the salt and sting of life in it, or it is not great.

Each age makes its own poetry. It cannot copy the poetry of a past age and produce living work. And poetry is not all in books, some is being made today. Only, it must be heard.

For that is the first thing poetry asks—to be heard. After that there are other things. There is the curiously magical effect of certain words, certain sounds, certain images brought together. There are lines that stir the mind like a bugle, and lines that fade away into forest distances. There are lines that seem to hold great wisdom and great peace. But they must be heard before they become part of our minds. The poet William Blake once wrote thus:

"What? it will be questioned, 'When the Sun rises, do you not see a round disk of fire somewhat like a guinea?' O no, no, I see an innumerable company of the heavenly Host, crying 'Holy, Holy, Holy is the Lord God Almighty!'

I question not my corporal or vegetative eye any more than I would question a window, concerning a sight. I look through it and not with it."

The difference between those two ways of looking at the sun is the difference between the prose way of looking at life and the poetic way. Not because poetry asks us to live in an unreal world, that is not its purpose. But it can make the world we live in different and more shining.

Poincaré, RAYMOND (Pron pwan kar' ä) (1860-1934) "A small man with a clear eye, a

strong hand and a steady head"—that is a description of Raymond Poincaré, President of France during the World War of 1914-18. Of all the French statesmen who conducted the affairs of the republic during the opening years of the 20th century, none had foreseen more clearly than he the impending struggle with Germany, and few had done more to prepare the nation for that conflict.

Born in Bai-Je Duo, on the borders of the province of Lorraine, lost to Germany as a result of the Franco-Prussian War of 1870, he early began the study of law in Paris, and rose to high rank in his profession. He plunged into politics, and soon achieved cabinet rank.

Then, in 1912, at a time when relations with Germany were in a critical condition over Morocco, Poincaré, now a senator, was called upon to form an administration as Prime Minister, in which he himself took the post of Minister of Foreign Affairs. He cemented the friendship of France with Great Britain and Russia, and when he was elected to the Presidency in 1913 he strongly supported the three-year military service bill as an answer to Germany's alarming army increases.

From the time the storm broke in 1914 until the end of the War, President Poincaré proved a steadfast influence towards victory. Day by day he drove about the streets of Paris, visited the families of those injured in air raids, called at the hospitals, spoke at public gatherings—always inspiring confidence.



PRESIDENT POINCARÉ AT THE FRONT

On November 2, 1918, Valenciennes for over four years in the hands of the Germans, fell to the Canadian 4th division. In this photograph the French president, M. Poincaré, accompanied by Lord Horne (then General Sir Henry Horne), commander of the British 1st Army, is seen inspecting a guard of honour of Highlanders shortly after the recapture of the town.

After completing his term of office as President of the Republic, Poincaré returned to politics and was thrice Premier. He was in power when France marched to troops into the Ruhr in 1923 to force reparations payments by Germany. In 1926 he did his greatest service to France when he stabilized the franc, and thus saved the nation from financial disaster. He resigned in 1929, and died five years later. Poincaré came of a distinguished intellectual family. His brother Lucien became a celebrated physicist, and his cousin Henri a mathematician.

Poisonous Plants. Every plant in the world has to protect itself if it is to survive, for there are enemies all about it. These enemies may be grazing animals, or the even more dangerous and destructive insects and fungi. One of the commonest forms of defense is the development of certain qualities within the plant itself which act as protective agents. At times these take the form of thorns, in other cases of evil-smelling substances, and in some instances of poisons, which are contained in large enough amounts to make the plants injurious when eaten or even touched.

Plants containing substances in their foliage, roots, or fruits, which are poisonous to mankind are scattered all through the vegetable kingdom, and the line between such poisonous and non-poisonous plants is not sharply defined. Some harmless plants contain traces of poisons which, if concentrated, are deadly. The fruit of the tomato, for example, is one of our most wholesome foods. Yet that of the deadly nightshade, a close relative, is exceedingly poisonous. The potato, too, is a member of the same group.

The foliage, roots and seeds of some of our loveliest and commonest garden flowers contain poisons. The plants with poisonous fruits, such as the deadly nightshade, with its brilliant scarlet berries, cause the most harm, especially to children. Poisonous fungi, mistaken for true edible mushrooms, often cause deaths (See colour plate facing page 1780).

Deadly Roots in the Garden

The roots of many plants of the aconite family are poisonous. Indeed, one of these plants, *Aconitum ferox*, contains one of the most deadly poisons known. It is this that supplies one of the famous poisons of India. Many of the aconites grow wild in mountainous parts of the Northern Hemisphere, and several are cultivated as garden plants, such as the beautiful monkshood. The roots of aconites look very much like horse-radish, and great care should be taken when dividing clumps of them in your garden not to leave any pieces of the roots where they might be mistaken for anything else, the smallest bit being poisonous.

Cattle and other live-stock are often made ill by eating poisonous plants which grow wild

in their pastures. The magnificent cow parsley, which grows 6 feet high or more, with its hairy stem and downy leaves, does cattle no harm, but the hemlock (*g v*), which looks very like cow parsley but has smooth leaves and hairless, purple-spotted stem, is very poisonous. From this plant the poison was distilled with which the great Greek philosopher, Socrates, was put to death.

Plants Whose Touch is Poison

Some plants are poisonous to the touch. Perhaps the most familiar is the stinging nettle, but this is nothing like so important as the members of the sumach genus. Contact with some of them is almost sure to cause severe inflammation and an intolerable itching, although people are affected in varying degrees. Chief among these is the poison ivy (*Rhus toxicodendron*), which is widely distributed throughout the United States. Even the common garden species, staghorn sumach (*R. typhina*), may cause trouble if its hairs become embedded in your skin. Some of those greenhouse favourites, the primulas, have to be handled with care. If you have a delicate skin you should not touch the hairy leaves, for they may produce a painful rash. The milky juice of several of the spurge (*Euphorbia*) causes similar irritation.

Poisoned arrows, used by savage tribes in almost every part of the world, were usually dipped in the poisonous juices of some plant, though snake venom and other deadly poisons were also used.

Poisons. The common poisons are usually classified according to the way they act upon the human body. (1) corrosive poisons, (2) irritant poisons, (3) nerve poisons, and (4) gas poisons. Substances which are used to counteract the effects of poisons are called "antidotes," from two Greek words meaning "given against."

The corrosive poisons are those which "burn" the skin or lining of the stomach. Among the commonest and the most dangerous chemicals of this class is corrosive sublimate, often called bichloride of mercury, which is widely used as an antiseptic. The antidote is the whites of eggs beaten up with water.

The irritant poisons are those which set up inflammation in the body and interfere so seriously with its functions as to cause severe sickness or even death. To this class belong most of the so-called cumulative poisons, those which can be absorbed little by little into the system without apparent harm, until eventually they strike down their unsuspecting victims. Arsenic and all its compounds are the most important of the irritant poisons. A table spoonful of dialysed iron at half-hour intervals is the antidote.

The most deadly of all poisons, however, are those which act directly upon the nerves.

PLANTS THAT ARE POISONOUS TO MAN & BEAST



All of the plants shown on this page have been used at some time as medicines, but in large doses they are active poisons. Some of them kill horses, cattle and other animals but are seldom fatal to human beings because the latter are not likely to absorb enough of the poison accidentally. The plants are (1) Cherry Laurel, (2) Deadly Nightshade, (3) Jimson Weed or Snakehead, (4) Henbane, (5) Water Dropwort, (6) Common Yew, (7) Monkshood or Aconite, (8) Larkspur. The roots of Henbane, Water Dropwort and Monkshood are poisonous; of the other plants the fruit or foliage is dangerous.

Of these prussic or hydrocyanic acid is perhaps the best-known. The fumes of this acid are sometimes used to rid dwellings of germs or vermin, but it is so dangerous that only highly-skilled experts should attempt to use it.

Aconite is an exceedingly deadly poison, which kills in very minute doses. It is derived from certain plants of the aconite family, most of which are poisonous.

Belladonna and its alkaloid atropine, which is used by oculists to enlarge the pupils of the eyes for examination, is a nerve poison. This drug and morphine are antidotes for each other. Belladonna is obtained from the deadly night shade plant.

Strychnine deserves especial warning mention in this group of poisons, because it is so frequently used to get rid of rats. Its effects are very rapid, resulting in convulsions and death within half an hour. Sodium bromide in alcohol is used as an antidote. The best method is to keep the patient resting in a dark room until the poison has been eliminated.

Gas poisons may be divided into two classes those which act as powerful irritants to the throat and lung tissues, like chlorine, bromine, the fumes of burning sulphur, and the nitrous

vapours produced in copper engraving, and those which act on the blood through the lungs and render it incapable of conveying oxygen.

Of the gas poisons the best-known is carbon monoxide, which occurs in coal-gas and motor car exhaust fumes. This is one of the second group of gas poisons, and its symptoms are similar to complete suffocation. Artificial respiration should be applied immediately. (See First Aid.) Gas poisons, principally of the irritant kind, played a large part in the World War. (See Gas Warfare.)

There are many other kinds of poisons, such as the ptomaines and hotulins, created by the action of certain bacteria or in properly kept foods, and other bacterial poisons like those which cause lockjaw (See Bacteria, Germ Theory of Disease). Many animals and plants secrete poisonous substances. (See Poisonous Plants.)

Poison Precautions

All poisons should be kept in bottles or boxes clearly marked with a red label to signify "danger." The bottles should also be coloured, so as to make them even more outstanding, and to prevent them being mistaken in the dark, they should always have grooves running down the sides and back.

WAR-BORN LAND of FIELD & FOREST

Once one of the great European powers, later only a memory of a country, now a new republic of importance, harassed Poland has had a stormy past. What she is making of the present is told here.

Poland. For more than 400 years Poland—the name comes from a word meaning "plain"—was one of the largest States of Europe, stretching for many hundreds of miles over the flat expanse of forest, swamp, and plain that lies between the Baltic and the Black Seas. It kept the Tartar hordes of the Russian steppes from the threshold of western Europe, and its king was at times the champion of Christianity against the Mahomedan Turk. Then it vanished entirely from the map through the greed of its neighbours—Prussia, Russia, and Austria.

Finally, a century and a quarter afterwards, there dawned a new day for Poland, and it rose phoenix-like from the flames and ashes of the World War. Its new leader was not a king or warrior, but a world-famous musician—Ignaz Paderewski! Where do we find a story more thrilling and romantic?

In the 18th century Poland was, next to Russia, the most extensive country in Europe.

Extent—Area, 150,000 sq. miles, estimated total population

33,225,000

Physical Features—Undulating plain, between lowlands of Germany and great plain of Russia. On the southern boundary are the Carpathian Mts. Chief rivers Vistula and Bug. Principal Products—Rye, wheat, potatoes, and other crops coal, iron and steel, textiles, oil. Chief Cities—Warsaw, cap. tal. (1,225,000), Lodz (638,000), Lwów (316,000), Poznań (266,000), Cracow (237,000), Vilna (207,000).

(These details are prior to the German invasion of September 1939.)

But its kings were elected by the nobles, and at each successive election the power of the crown was diminished, so that in time the king became practically powerless. The Diet, or legislative body, which had all power of making

peace or war and levying taxes, was composed exclusively of representatives of the nobles. By what was known as the *liberum veto*, any one of these could rise and exclaim, "I disapprove," and so defeat any measure which came before the Diet. There was no middle class in the population of about 1,000,000 nobles and 13,000,000 serfs, and the peasants were utterly miserable. The estates of many of the nobles were so small that it was jokingly said that when the noble's dog lay down in the middle of the estate, his tail would extend beyond its borders.

Poland's greedy neighbours to the east, west, and south blocked every effort to reform this state of affairs. Then Catherine II of Russia

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determined to seize a portion of Poland, and Frederick the Great of Prussia persuaded Austria to join him in forcing Catherine to share the booty with them. By three successive partitions—in 1772, 1793, and 1795—Poland was wiped off the map and its territories annexed to Russia, Prussia, and Austria.

Napoleon Bonaparte created a Duchy of Warsaw, but on his fall the country was divided again between the three great powers surrounding it. Attempted revolts in the Russian portion were put down with great cruelty.

When the War of 1914-18 came millions of Poles were enlisted in the armies of Germany, Austria and Russia, and often had to fight one another, while their country was laid waste as was Belgium in the West. But there were many patriotic Poles who dreamt of regaining national status, and at the Peace Conference at Versailles in 1919 their pleas were heard and granted. Poland was reborn as a great nation-state between Germany and Russia, and by way of the "Polish Corridor" was given an outlet on the Baltic. Danzig, it is true, was made a "free city," but Poland at once set about creating a new port at Gdynia, which already has a population of about 80,000.

In the first provisional government Paderewski was Premier and General (later Marshal) Pilsudski was President. Hostile neighbours, political inexperience and economic distress threatened the life of the young republic, and from 1926 until his death in 1935 Pilsudski was virtually dictator in all but name. He was succeeded by General Smigly Rydz, during whose rule, in March 1938, Poland presented a successful ultimatum to Lithuania demanding the restoration of normal relations.

In October 1938, following prolonged agitation, Poland was awarded the Teschen or Olsa area, totaling 770 square miles and 250,000 inhabitants. Following the German annexation of Czechoslovakia and Memel in March 1939, Britain guaranteed Poland's frontiers against aggression. This guarantee came into operation on September 3, 1939, two days after Poland had been invaded by Germany. The Poles resisted the invader and in some cases attacked



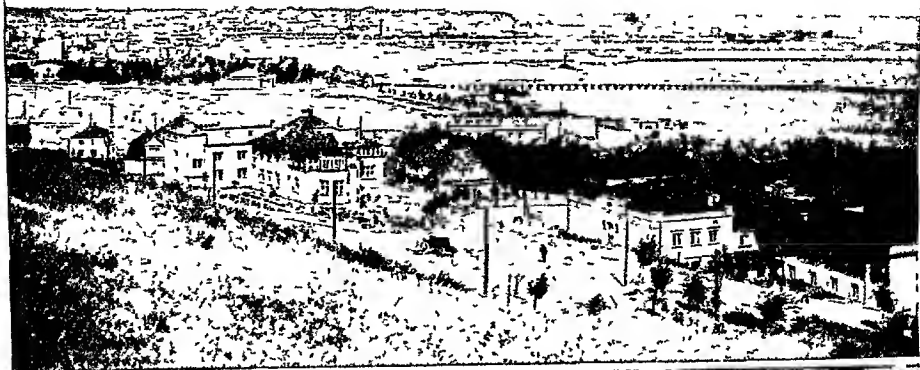
POLAND, BEFORE THE GERMAN-RUSSIAN INVASION, 1939

on their own account, but air raids caused great havoc in Polish territory. The great weight of the German mechanised attack told, and the Poles were forced to retreat halfway across the country in a fortnight. They were then confronted with an invasion on their eastern frontier by Soviet Russia. Despite the heroic defence of Warsaw the country was conquered in under a month, Germany and Russia partitioning the territory between them.

What sort of a place is Poland? Despite long winters, wet springs, and much marsh area, the soil of the northern two thirds of Poland is fairly fertile and most of it is cultivated. Rye, oats, wheat and barley, sugar-beets, and potatoes are the chief crops. Southern Poland has coal and iron in Polish Silesia, and brown iron ore, coal, lignite, zinc, tin, copper, oil, and sulphur.

The Polish villages consist usually of two straggling rows of thatched, one storeyed stone huts, plastered with mud, and turning their gable ends to the uncobbled street between. Inside the houses there are usually two rooms. In the first, the "hot room," the whole family lives, its stove reaching almost to the ceiling, in which logs and blocks of manure are burned. The

NORTHERN PORT & SOUTHERN VALLEY OF POLAND



Not long ago Gdynia, seen in the upper photograph, was a small fishing village, but it was rapidly developed until it became Poland's main seaport and naval base. In the background is the Marshal Pilsudski Harbour. In contrast, the lower photograph shows us a peaceful scene in the valley of the upper Vistula, close to the river's source in Silesia. The Vistula was Poland's greatest waterway, and its course of 620 miles lay almost entirely within Polish territory. It is subject to extensive flooding in the spring, when great damage is often caused.

Photos: Henryk Podczok, courtesy of Polish Travel Bureau

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windows let in light but never fresh air, and above the stifling heat and stuffiness is an overpowering odour of sour cabbage and garlic-flavoured beetroot stew. From the other room, the "cold room," there emerges at daybreak a procession of perhaps two cows, a pony, several dogs, some pigs, and many fowls.

The peasants are of Slavic stock more or less mixed with other races. Their costumes are often very picturesque. The men usually wear buff woollen breeches, a jaunty short coat decorated with scarlet and blue ribbons, and a small round black felt hat. Their women folk appear wrapped in a flaming rose and yellow shawl, beneath which you catch glimpses of an embroidered green velvet bodice and a full white linen skirt reaching barely to the knees, with high-heeled boots of crimson leather studded with yellow. They wear beads of every hue, long silver ear-rings, and bright coloured kerchiefs headdresses, which lend additional glory to their



POLISH PEASANT WOMAN

The Poles have always been an agricultural people, and most of them still derive their living from the land. A very wide stretch of wheat-bearing land extends from Warsaw to the rich black-earth belt of Podolia, in south eastern Poland. Above is a woman of Podolia at work in the fields.
Photo: Fiat courtesy of Polish Tract Bureau

Poland has given many great men and women to the world. Think what has been Poland's contribution to beauty and knowledge in the genius of Mickiewicz, her greatest poet, of Sienkiewicz, whom we know best as the author of "Quo Vadis", and Joseph Conrad, one of the master story tellers of the English language. Recall that Madame Curie, the co-discoverer of radium, was a Pole, and that to this same race belong Chopin, and the veteran musician and statesman, Paderewski.

costume and bring out the ivory-tinted pallor of their small oval faces and the dark brightness of their long-lashed eyes.

Before 1939 there were many Jews in Poland—some 3,000,000 of them, dating from the days when there was no middle class but only landed nobles and oppressed serfs. So Jews became the innkeepers, pedlars, money-lenders, shopkeepers, artisans, factory workers, and commercial travellers.

Although she was suppressed for so long,

EXPLORING the ENDS of the EARTH

No stories of human courage are more thrilling than those of the great Polar explorers, whose adventures, though they have so often led to a lonely death amid the ice, are an inspiration to us all.

Polar Exploration. The history of Polar exploration goes back many centuries. It starts, perhaps, with that friend of King Alfred the Great, the Norwegian Ottar, who with his Northerners discovered the White Sea, and his even more venturesome countryman, Eric the Red, who discovered Greenland c. 982.



Britain's flag above a newly-discovered peak in Arctic Canada. Oxford Littlerose Expedition

have led over ice pack and glacier, through strange waters and over ice-bound mountains. Many nations have contributed leaders to this ex-

ploration or equipped their costly expeditions—Norway, England, Portugal, Holland, Russia, Sweden, the United States, Germany, Austria and Italy. So many are the gallant men who have taken part in the hazardous work of Polar exploration that only the greatest of the expeditions can be touched upon here.

In the exploration of the North Polar regions one of the first of the great names is that of Sir Martin Frobisher (qv), a courageous gentleman of Queen Elizabeth's day, who sailed into the Polar seas and discovered Frobisher's Bay, on the coast of Arctic America. After him came Davis and Baffin, both Englishmen, and Bering, a Dane. Henry Hudson, another Englishman, also left an imperishable name in geography. He and many who followed him worked for two great English trading companies, the Muscovy Company and the Hudson's Bay Company.

Navigation in those days was very difficult, not only because of the tiny ill-fitted ships used,



TOWARDS THE POLE UNDER THE ICE

Do you remember how, in "Twenty Thousand Leagues under the Sea," Jules Verne described the wonderful adventures of Captain Nemo and his submarine, the Nautilus? This was all pure fantasy in 1869, but in 1931 another Nautilus, commanded by Sir Hubert Wilkins, travelled far beneath the Arctic ice. Here is the modern Nautilus in Polar waters.

but also because of the woeful lack of knowledge of the day. Hudson wrote quite seriously in his log that his men had seen a mermaid. Everyone believed in devils and evil spirits, and, what was perhaps worse still, the charts were all entirely wrong. Whole lands, "invented" and drawn in the charts, confused navigators for centuries.

In 1831 Captain John Ross reached the North Magnetic Pole on the west shore of Boothia Peninsula. Sir John Franklin's ill-fated expedition did more for Polar exploration in the end than any other single factor in the 19th century. The expedition sailed from England in 1845 to find a north-west passage and, after three years of hardships and disaster, perished on the shores of Boothia. (See Franklin, Sir John). The relief expeditions which were sent out to ascertain the fate of these men discovered and explored 7,000 miles of Arctic coast line. One of these expeditions was led by Captain Robert McClure. His ship was lost off Banks Land, but he pushed on with his crew across the ice and was finally found and rescued by another expedition, which brought him home to England in 1864. He had discovered and traversed, though not in the

same ship, and partly across ice, a north-west passage. For this feat he was knighted and received £10,000.

In 1882 seven nations set up stations in the Polar regions for simultaneous meteorological and magnetic observations—the first attempt at organized scientific research there.

While the North American Polar regions were thus being explored, the European and Siberian shores of the Arctic Ocean had also been investigated, at first in the search for a north-east passage and later for scientific purposes. The great territories of Spitsbergen, Franz Josef Land and Novaya Zemlya were charted. Then men began to turn their attention more and more to the Pole itself. Of the numerous attempts to reach this goal, one of the most interesting was that made by the Norwegian scientist, Fridtjof Nansen (*qv*), after whom Franz Josef Land has now been renamed.

Dr Nansen had noticed that wood drifted from the coast of Asia across the Arctic Sea and arrived finally in the North Atlantic, between Greenland and Europe. On this and other grounds he decided on a most daring course. He constructed a ship named the *Fram*, making it especially strong to resist crushing by the ice, and shaping it so that the ice masses meeting it would lift the ship out of water on top of the ice. In this ship in 1893 he allowed himself to be frozen into the ice-pack north of Siberia, with a company of 13 men. For three years they slowly drifted westward.

Nansen was quite right in his theories, and the only disappointment was that they did not drift quite far enough north to reach the Pole itself. Nansen himself, therefore, with one companion, left the ship and dashed for the Pole, but was unable to get farther than 86° 14' N. Four years later an Italian expedition under the Duke of the Abruzzi made a dash across the ice from Franz Josef Land to 86° 34' N.

Balloonsists Perish on the Ice

Of the many tragic mysteries of the frozen north one of the strangest is the fate of the Swedish aeronaut, S. A. Andrée (*qv*), who on July 11, 1897, set forth from Spitsbergen in a balloon, with two companions. After a few days nothing more was heard for 33 years. In 1930 their remains were found on White Island.

But the real hero of the North Polar exploration is Robert Peary. For 18 years he tried, leading eight expeditions, and was finally rewarded by achieving a great victory. When Peary arrived

POLAR EXPLORATION

back in civilization in 1909, after having reached the North Pole, he found the world raging with controversy over the claim of Dr F A Cook that he had reached the Pole a year before Peary. Cook's story was soon generally discredited, and Peary was left as undisputed victor in the quest. (See picture page 3161)

The Antarctic regions, around the South Pole, were not explored to any extent till after the North Polar regions were well charted. The South is farther from the centre of European civilization, and the climate there is more severe than in the North. Instead of being, like the North Pole, on a sea surrounded by land, the South Pole is on a vast continent surrounded by sea. It is very difficult to reach this continent because of the Great Ice Barrier which surrounds it, so that the early explorers merely touched here and there.

Explorers of the Far South

The work began with Captain James Cook, who in 1772-75 sailed entirely round this region, but at only two points—in the South Pacific—penetrated the Antarctic Circle. Other men, including the American naval officer Charles Wilkes (1798-1877), carried these explorations further, and in 1840-43 Sir James Ross discovered Ross Sea and formally took possession of South Victoria Land for the British Government.

In 1902 Captain Robert Scott (*qv*), of the British Navy, made the first explorations ever made on land in the Antarctic. Starting from South Victoria Land, he penetrated some distance into the interior, discovered a chain of mountains, several glaciers, etc., and did much valuable scientific work.

Another English explorer, Sir Ernest Shackleton (*qv*), made a dash for the Pole in 1907-09, starting from near Scott's base, and got within 97 miles of it, but was obliged to turn back. Two of his party did, however, locate the South Magnetic Pole.

On a second expedition Captain Scott actually reached the South Pole on January 18, 1912, only to find that Amundsen had been there about a month before him. In one of the most tragic and heroic stories of history, Scott and his party perished on the way back to their ship. (See illustrations on pages 201-204)

Thus the glory of discovering the South Pole fell to Roald Amundsen, a Norwegian explorer who had already won honours in the Arctic. One dark day in December, 1905, his dog-sledge had dashed into Eagle City, Alaska, having traversed the icy wastes which separated that outpost of civilization from his little ship the *Gjøa*, then frozen in near Boothia and conducting observations at the North Magnetic Pole. Returning the way he had come, Captain Amundsen next spring brought his little vessel with his five companions through the North-

west Passage to the Pacific—the first ship to complete the passage. (See Amundsen, Roald)

Four years later, in Nansen's ship the *Fram*, Amundsen sailed south to conquer the South Pole. He wintered at the Bay of Whales, on Ross Sea, spent the following summer establishing three supply depots on the way to the Pole, and the following winter gathering 132,000 pounds of seal meat for the dogs and baking 42,000 loaves of hard bread for the men. Then, on October 20, 1911, after having made one bad start, he commenced his final dash. He reached the Great Ice Barrier surrounding the 10,000 foot high Polar plateau on November 17, and the Pole on December 14. After three days spent taking observations, he made the return trip without mishap, and the following March the world heard of his achievement.

Even then the urge to reach the Poles did not end. Various attempts to reach the North Pole by air had failed, but in 1926 this new



'HARD GOING' IN ARCTIC CANADA

The Oxford University expedition to Ellesmere Island in 1935 made many useful discoveries and came across an unexplored mountain range, which was provisionally christened the British Empire Range. This photograph shows some difficult going for the sledges over the rough hummocks.

POLAR EXPLORATION

method of exploration was crowned with success. The first flight was made by Lt.-Com Richard Byrd of the American Navy. Flying from Spitsbergen on May 9, Byrd made the trip to the Pole and back (about 1,600 miles) in 15½ hours. Three days later the North Pole was crossed by Amundsen in an airship piloted by Col Umberto Nobile, of Italy. The trip from Spitsbergen to Teller, Alaska, took 71 hours.

In 1928 Capt. Sir Hubert Wilkins flew in an aeroplane from Point Barrow, Alaska, to Spitsbergen (about 2,200 miles) in 20 hours. Nobile reached the North Pole again in May, 1928, but his airship Italia was wrecked and eight of the crew were lost on the return trip. Amundsen and five others who flew to the rescue perished.

These flights awakened the nations to the vast commercial and military possibilities of air

routes in the Arctic. By comparatively short flights across the Polar Sea Canada can reach Russia, north-west Europe is joined closely to the Far East and Alaska becomes a near neighbour to Siberia and northern Russia. The shortest air route between England and Canada is across the Arctic, over the Faeroes, Iceland, Greenland, and Baffin Island, and survey expeditions to Greenland under the direction of the late Gino Watkins, Augustus Courtlandt, and others have done much to investigate the possibilities of this little-known region. There are still, however about 1,000,000 square miles of unexplored territory about the North Pole.

Commercially, an Arctic route would revolutionize shipping. Freight and passengers that now move from Europe to the Far East by the Suez or Panama canals, crossing the widest

oceans, would have a straight course over the "top of the world." Flying north between Greenland and Spitsbergen, over the Pole and Bering Strait, planes could bear south to Japan and China, and bring western Europe within a few days of the Far East. Aircraft bound for America's west coast could strike east of the Aleutian Islands and reach Seattle or Vancouver in a matter of days. The saving of time, fuel, and costs by this annihilation of distance can easily be imagined. Short air routes linking Canada and Russia, Alaska and Norway, Siberia and north-western Europe, would criss-cross the air above the Polar sea, until the Arctic coasts would become among the most important in the world.

The foremost advocate of these direct airways across the Arctic is the explorer Vilhjalmur Stefansson. He knows the North American Polar regions through 11 years spent in the "friendly Arctic," and by a series of



SHIP THAT RESCUED POLAR FLIERS

After being missing for nearly two months in the Antarctic, Lincoln Ellsworth, the American explorer, and his pilot, whose aeroplane had been forced down through fuel shortage, were rescued in January, 1936, by the British Royal Research Ship Discovery II, seen in the photograph above. She is here shown lying in Vica Bay, King George Island.

explorations carried out over some 100,000 square miles previously unknown. On the Canadian Arctic expedition (1913-18), Stefansson frequently left food supplies behind and set out across the ice to "live on the country" like the Eskimos, finding hountful nourishment by hunting sea and land animals.

Because of the vast possibilities of these Arctic air routes, the lands over which they pass have assumed a new importance. Canada claims sovereignty over all the lands between her north coast and the Pole, while Denmark, Norway and the United States also claim vast areas.

But it is Russia which has the biggest share of Arctic territory, and has made the greatest strides in recent years in the conquest of the Arctic. In 1937-1938, a camp, equipped with wireless, was established under the direction of Dr. Otto Schmidt in the ice floes near the Pole, which was reached by air. A Russian aeroplane gave a foretaste of future developments by flying right over the Pole non-stop from Moscow to San Jacinto, California.

Antarctic exploration increased, as never before, from 1928 onwards. Byrd, promoted later to Rear Admiral, led an expedition which cost more than £200,000 and spent almost two years at Little America, a base on the Ross Sea Barrier on the Bay of Whales. On November 29, 1929, Byrd and three companions flew over the South Pole. Their trip of 1,600 miles was made in 19 hours. Byrd's expedition discovered, mapped, and claimed for the United States some 150,000 square miles of new territory, which Byrd named Rockefeller Range, Marie Byrd Land, and Charles V. Boh Mountains. Signs of vast coal deposits were found.

Sir Hubert Wilkins also transferred his explorations from the Arctic to the Antarctic from 1928 to 1930. Flying from bases at Deception Island and Adelaide Island, he explored 300 miles of new coast line and discovered that Charcot Land is an island, not part of the continent, and that Graham Land (to which a British expedition sailed in 1934) consists of two islands. Capt. Hjalmar Ruser-Larsen, flying from a Norwegian exploration ship in 1930, discovered new land between Enderby and Coates Lands, and claimed it for Norway. Sir Douglas Mawson—like Wilkins, born in Australia—in 1929-30 charted some 300 miles of previously unknown coast along the Antarctic Continent,



NEW TERRITORY FOR BRITAIN

Previously unknown land in the Antarctic was discovered by the Mawson expedition of 1930-31, and named Princess Elizabeth Land. Our photograph shows members of the expedition led by Sir Douglas Mawson singing the National Anthem after the Union Jack had been hoisted and the new land officially claimed for Great Britain.

and discovered and claimed Enderby Land for Australia. He continued his efforts in 1931. Admiral Byrd in 1933-35 led a second expedition to Antarctica, where he explored new areas.

The work of the Discovery Committee, formed under the British Colonial Office shortly after the World War, is especially interesting and important. Their first ship was Scott's famous *Discovery I*, this carried out a series of successful voyages before being presented to the Sea Scouts by the Committee in 1937. A new all-steel vessel, the *Royal Research Ship Discovery II*, voyaged to the South Seas in 1930.

Another chapter, happily not tragic, in the eventful history of Antarctic exploration was written when the *Discovery II* rescued the American explorer Lincoln Ellsworth and his pilot, Hollick Kenyon, whose aeroplane had been forced down not far from their base in Little America. (See also Antarctic, Arctic)

BRAVE GUARDIANS of LAW and ORDER

We do not realize how much we owe to the blue-coated police officer. He stands for the whole order of our civilization, our laws and our liberty, and as such we should respect and help him

Police. The policeman, who seems so necessary to the life of all big cities, is a comparatively modern figure. It is difficult to



understand how people could have got along without him, and, in fact, they did not get along very well. In England, until 1829, the only peace officers were the constables and watchmen who more or less ineffectually patrolled the streets at night. The result was that crime was

rampant in London and other parts of England. Bands of drunken roistersers terrorized, maltreated, and robbed citizens with impunity. Highwaymen infested the roads, robbers and burglars carried on their work openly. The watchmen were often corrupt and shared the plunder of thieves. It was estimated that in London at the beginning of the 19th century there was one criminal for every twenty-two people of the population.

This condition continued until 1829, when Sir Robert Peel laid the foundation of a better system. It is true that there had been police systems long before that time among the nations of continental Europe, but they were used chiefly as instruments of tyranny. The police of Louis XIV of France, and later of Napoleon, were examples of this. They spent most of their time prying into political secrets and interfering with the private lives of the citizens, paying little attention to the suppression of crime.

When the Police Force was Invented

So, when Sir Robert Peel proposed his plan, he met with strong objections from liberty-loving Englishmen who feared the French system. He was able, however, to convince Parliament of the soundness of his scheme, and the foundation of the present British police system was laid. The modern British policeman is known as a "bobby" after the founder of the system. (See Peel, Sir Robert)

The formation of the Metropolitan Police in 1829 was gradually followed by the adoption of similar principles for policing the provinces, and now the whole country is efficiently guarded by police, controlled, with the exception of London, by the local authorities. In 1920 the

employment of policewomen was started, and in the later years Londoners for the first time saw mobile policemen on motor cycles. These latter are used both for controlling traffic and also for following up criminals on the road.

The Metropolitan Police, who cover an area extending 16 miles in radius from Charing Cross, are under the control of the Home Secretary. The head office of the force is New Scotland Yard, off Whitehall, and the principal officer is the Commissioner, who acts under the direct authority of the Home Secretary. Next to the Commissioner are a Deputy Commissioner and three Assistant Commissioners. Of these, two are responsible for the general discipline of the force, and the third is in charge of the Criminal Investigation Department (CID). The modern detective is a descendant of the old time "Bow Street Runner."

After the Assistant Commissioners come the five Chief Constables, and then the remaining ranks are superintendents, chief inspectors, sub-divisional inspectors, inspectors, station sergeants, sergeants, acting sergeants, and constables (P.C.s). Mounted police are used on very long and lonely beats, during processions, and on other special occasions.

What the 'Bobby' Does

Among the regular duties of the Metropolitan Police—they number nearly 20,000—are the regulation of traffic and control of the streets, appearing as representatives of the law at the scenes of accidents and crimes, attending at polling stations during elections, and seeing that the motoring laws are enforced.

The City of London Police, created in 1839, are a distinct organization controlled by the City Corporation. The Commissioner is appointed by the Court of Common Council. The Force comprises 1,260 men.

Special constabulary are also recruited for auxiliary service in the Metropolitan and City Police areas.

The police have enlisted the aid of all kinds of modern devices to combat crime. Fast police cars equipped with wireless patrol the highways, while the "Dial 999" system introduced for emergency purposes in the London telephone area has proved amazingly efficient.

To train police officers for the metropolitan service, the Metropolitan Police College was founded at Hendon. Suitable candidates are admitted in three ways: (1) by competitive examination open to outsiders as well as to those already in the force, (2) by selection

POLICE

without examination, for those who possess university degrees, etc., (3) by selection from suitable constables and others already serving. Full particulars of the Police as a career may be obtained from New Scotland Yard.

There are also police forces in many of the cities and large towns of Britain, and county constabulary in the remaining districts. All are under the supreme control of the Home Office. The total number of police in England and Wales is about 60,000, while Scotland has 8,600 and Northern Ireland 2,870.

Of police forces overseas the most famous is perhaps the Canadian Mounted Police, formerly called the Royal North-West Mounted Police. The "Mounties," 2,000 strong, cover an area of over a million square miles.

If you live in even a small village, you are bound by the Law. It tells boys that they must not throw stones or snowballs in the streets, for they might break windows or hit people—perhaps cause a motorist to lose control of his wheel and crash into another car, bringing death or injury to himself or to others. It tells them not to climb fruit trees without the owner's permission, for they might break down limbs. It tells them they must not chase cats or tie tin cans to dogs' tails or rob birds' nests or use catapults on birds. The Law forbids cruelty to helpless animals. You see, all laws are just good common sense and kindness.

Laws are rules for good behaviour. You know how much trouble one selfish, ill-tempered member can make for a whole family. It is the same in school. One unruly pupil can make trouble for a whole room. One boy who is a "bully" on the playground can spoil everybody's fun. Little law breakers become big law breakers when they grow up. Then they find that if they interfere with other people's rights, officers of the law will arrest and punish them. It is better to learn to be good citizens in the home and school, for then it will be easier to obey laws when you grow up.

In small places very few people break laws, because everybody knows everybody else, and a selfish troublesome person soon gets himself disliked and goes away. He is likely to go to a city. He thinks that where there are so many people he will not be noticed, and he can do as he pleases. But there he finds a whole army of policemen whose business it is to keep order. Policemen are the friends and protectors of everyone who behaves well, and the enemies of everyone who makes trouble for other people. Policemen always look out for children.

Some schools in cities are in crowded streets where traffic is always passing. Often the children have to cross such streets to get to school. In these dangerous places there is usually a policeman to help the children across. When he lifts his hand, every vehicle has to stop. Often he picks up a little toddler who is afraid, and carries her across the street. If a policeman finds a lost child on the street, he summons a police car and gives the baby a ride to the police station. There he is fed and petted and put to sleep. Then the policeman goes to find the baby's mother and father. A policeman is the best strange friend a little boy and girl can have. You see, he is a peace soldier, and it is his



TRAINING POLICE HORSES

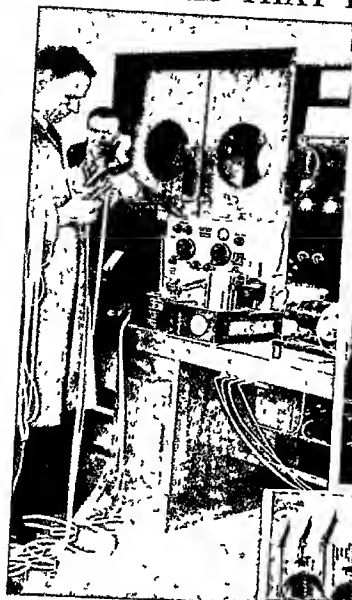
The horses of the mounted police undergo a rigorous training to accustom them to the sights and noises they are likely to encounter when on duty. This horse is obviously well trained, for she remains quite unperturbed while a flag is waved in front of her.

Fox Photos

chief business to take care of people.

Policemen are often in as great danger as firemen. Sometimes they reach a fire before the firemen. If they do, it is their duty to go into the burning house and help get people out. They often stop runaway horses, and snatch people from under horses' hoofs and car wheels. They dive into rivers to save people from drowning. The most dangerous work policemen have to do is to find and arrest criminals. Many of these evil men will kill rather than be captured and sent to prison. But policemen will go right into dark houses and alleys, after men who may be waiting for them with guns and knives. Plain clothes policemen, or detectives, are in every big crowd watching for

DEVICES THAT HELP THE POLICE



(1) New police wireless transmitting station, at West Wickham, Kent (2) Giving orders in a traffic block by loudspeakers (3) New alarm signals for calling police assistance in the City of London (4) Model traffic signals for teaching the Home Office Experimental Patrol, known as the "Courtesy Squad" (5) River police boat on the Thames



POLICE

pickpockets, and they are often found in dangerous parts of the city where criminals try to hide. In such areas, often referred to as the "underworld," detectives spend much time, learning the faces and habits of the criminal classes.

The traffic policemen are among the tallest and strongest in the force. They stand in the middle of street crossings in the crowded parts of the city, guarding people who are afoot, and keeping the streams of vehicles from getting in a tangle. Some policemen use motor cycles or cars to catch speeding motorists. There are special policemen who watch railway stations and port docks, where visitors who do not know city ways are likely to get into trouble. There are always a great number along the line of processions, and at meetings and other special occasions.

The policeman you know the best has a regular "beat" to patrol. A policeman on his beat goes over his district several times a day. At night, another man takes his place. He has to see that no law is broken, and that everyone is protected. Some night, when you are asleep, there may come a ring at the door. A policeman calls up that he has found a downstairs window unlocked. He goes through the place to see if a burglar has broken in. No, he says you were careless and left that window open. Your father thanks the policeman for watching your house so vigilantly, and that makes you all the more careful afterwards.

A policeman must see that people obey the laws of health and good conduct. He must stop fights and scatter noisy crowds. He must arrest anyone he finds ill-treating a child or an animal. He must take care of persons injured in the street, send them home or to a hospital, and find the persons responsible for accidents.

Always answer a policeman's questions and obey his orders. He is an officer of the law and he has a right to stop and question people,

he has a right to ask for your help, if he needs it. Don't look upon the policeman as an enemy. Be open and above board and don't hide or try to play tricks. Active boys can help a policeman to keep order on his beat, for they see everything that is going on.

Polo. This fine sport is one of the oldest that we play today. There seems to be no doubt that it came from the East. Twelve hundred years ago the Persians were playing it, and the Chinese maintain that their ancestors

were playing in polo matches many thousand years ago. More polo is played in India than in any other part of the world, chiefly by Army officers. It was brought from that country to England, where its introduction at the Hurlingham Club (still the national headquarters of the sport) brought it immediate popularity.

There are four players on a side, each mounted on a pony that has been trained specially for the game. In fact, there are many polo ponies that play the game quite as well as their masters do. They follow the ball like a terrier after a rat, and wheel and turn seemingly at the very thought of their masters, who are equipped with sticks to send the ball towards their opponents' goal.

In a polo team, Nos 1 and 2 are forwards, No 3 (usually the best player) a forward or back as occasion demands, and No 4 the back. Each player when qualified receives a handicap which represents his supposed value to his team in terms of goals. A great match held periodically is the Westchester Cup, between Britain and America.

The polo field is a rectangle of turf, 300 yards long and 160 yards wide, with a goal 8 yards wide at each end marked by posts. The polo stick, which somewhat resembles a croquet mallet, has a long handle and an 8 inch head—usually in England of square shape. The ball is driven with a full free swing, and with the flat side of the mallet. The ball, which the players try to drive through the goals, is of

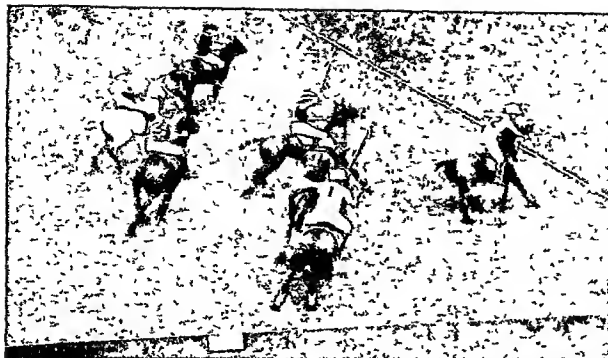


Durston 1919

POLICING THE WIDE OPEN SPACES

Here a lone Mountie, as the men of the Canadian Mounted Police are popularly called, is seen scanning from a peak in the Rockies the marvellous expanse of the Banff National Park in Alberta, one of the most picturesque spots in Canada.

POLO



INTERNATIONAL POLO MATCH IN PROGRESS

The game being played here is one of the most ancient in the world. Cradled in Persia, it spread to India, where it was taken up by British officers and so spread over the world. This photograph shows American and British teams competing for the Westchester Cup at Hurlingham in 1936. The ponies are specially bred for the game, which is very fast.

light wood, painted white. Seven periods ("chukkers") of 8 minutes make the game.

The entirely unrelated game of water polo is described under its own heading.

Polo, Marco (about 1254-1324). One day, in the year 1295, three bearded and travel-stained men appeared in the Italian city of Venice. They were strange figures among the gaily-clad Venetians, for the travellers were dressed in worn garments of curious material and outlandish cut. So strange did they look that when they announced that they were Nicolo and Maffeo Polo, with Nicolo's son, Marco, and that they were just returned from 20 years' absence in Cathay, even their kinsmen could hardly believe them.

At a feast given by the newcomers, Marco Polo brought out then three soiled coats of quilted cotton. With a sharp knife he cut open the seams, and he poured out handfuls of precious stones. This wealth they had acquired at the court of the great Kublai Khan, Emperor of China or Cathay, and they had brought it in this form, knowing that they could not carry gold of the same value. This convinced the Venetians.

Soon after their return, Marco, the youngest, was captured in a sea battle between Venice and Genoa and carried off a captive to the rival city. While in prison there he fell in with Rusticiano of Pisa, a scribe, to whom he dictated his adventures.

The story told in the book is this: Nicolo and Maffeo Polo—Marco was then a baby, and was left at home—went on a trading speculation to the Crimea, and thence on to Bokhara in Turkistan. There they met some envoys from the court of Kublai Khan, the great Mongol Emperor who ruled over most of Asia. With these envoys they journeyed to China, which the Khan had conquered in 1267, and were there received with much favour. The Khan had never met any Europeans before, and was much interested in what they had to tell him. After a time he determined to send them back to Europe as his envoys to the Pope, asking for 100 missionary teachers to be sent to China.

So the Polo brothers had returned home to Venice in the year 1269, when Nicolo found that his wife was dead and his son Marco almost grown up, about 15 years old. After many delays they succeeded in giving Kublai's message to the Pope. They then set out again for China (1271), taking with them the young Marco.

When they arrived at the court of Peking, the Grand Khan Kublai took a great fancy to young Marco, and sent him on many journeys.



MESSER MARCO POLO

This quaint old illustration, taken from a book called "Le Livre des Merveilles," or "Book of Marvels," depicts the famous Venetian traveller of the 13th century, Marco Polo, wandering through strange lands. In 1295, while fighting with the Venetian fleet, he was captured by the Genoese, and while in captivity dictated an account of his travels in Persia, India and China.

This time the Polos dwelt in Cathay for about 20 years. Many times they wished to return to Venice, but Kublai Khan would not hear of it. When at last they were given permission to depart, it was to accompany a young princess who was destined to be the bride of the Khan's grandson in Persia. Early in 1292 they finally left China.

The trip to Persia was made by sea, and the Polos were the first Europeans to sail those seas. Many of the party died by the way, but the three Polos and the young lady survived. Marco lived to be over 70 years old.

Marco Polo was thus the first traveller to trace a route across the whole breadth of Asia and to describe Persia, the Mongolian steppes, China and India, Japan and Ceylon, Java and Sumatra, and many other places.

Pomegranate. (Pron pom' gran at) Owing to the fact that the lemon and orange were unknown in early Europe, the acid of this fruit was especially acceptable to the ancient Greeks and Romans. From the days of the ancient Assyrians and Egyptians, also, the pomegranate has been a symbol of beauty. Its large brilliant scarlet flowers, as well as its reddish golden fruit, rather larger than an orange and of quite different texture, have inspired countless allusions in literature and representations in ancient sculpture.

The pomegranate is little used today as an article of food, for the pulp, which though palatable is mixed with a good deal of pith, is merely a coating for the innumerable seeds. It is still in favour in Mexico and Persia, however, in the making of beverages. From the leathery rind of the fruit, from the bark of the tree, and from the root, tannin is extracted for use as an astringent in medicine and in tanning leather. The pomegranate grows wild in Afghanistan, north western India, and south-west of the Caspian Sea, and is widely cultivated throughout the tropics and sub tropics. Its botanical name is *Punica granatum* (*Punicus* meaning Carthaginian, because it was imported by the Romans from Carthage).

Pompeii. (Pron pom-pā'-ē), ITALY. For 600 years the ancient city of Pompeii had nestled on its plateau of ancient lava, on the Bay of Naples, less than a mile from the foot of Mount Vesuvius. It carried on a prosperous trade in wine and oil, and many wealthy Romans had built villas there.

Then, on the morning of August 24, in the year A.D. 79, the great volcano suddenly awoke from its centuries of slumber and began pouring forth a great column of cinders, pumice stone, and ashes. A dense black cloud shot up to an enormous height and overspread the heavens. It blew rapidly towards Pompeii, shrouding the city in darkness, broken only by lightning

flashes, and there descended upon the doomed city a hail of pumice and volcanic ash. For three days the terrible rain of fire continued.

Most of the population escaped, but some of those who sought to flee in boats had those sink beneath them under the weight of the ash. Others who sought refuge in cellars were suffocated by the stifling sulphur fumes or crushed under falling roofs. About 2,000 persons perished out of a population of 20,000. At each of the eight gates, the sentries, true to the stern Roman ideal of duty, died at their posts, and there their remains have been found embedded in the ash. When the darkness lifted on the



FINE CROP OF POMEGRANATES

Growing wild in Asia the pomegranate has been cultivated from time immemorial in the Near East and Mediterranean region, and here is a small tree growing near Jerusalem and in full fruit. The fruits are deep reddish in colour.

Photo American Colony Jerusalem

third day Pompeii lay buried under eight to ten feet of pumice and six or seven feet of volcanic ash. So great was the alteration of the sea coast that the site of the town now lies nearly two miles inland.

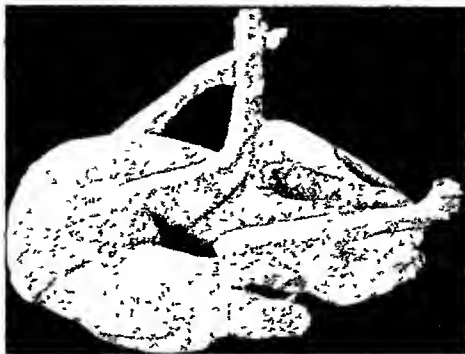
Under this blanket of death the city remained buried and gradually forgotten for nearly 1,700 years. In 1748 a peasant came across traces of it beneath his vineyards. Since then the city has been gradually dug out, bit by bit, until now its ruins tell us the story of Roman everyday life as it is told nowhere else. Here you may walk between rows of shops and houses, along street after street with the marks of the horses' hoofs and the ruts worn by chariot wheels in the paving blocks. You may also

POMPEII

read announcements of shops to rent or gladiatorial contests, and election notices scrawled in flaming red letters

Public life, as shown by excavations, centred in the forum or market-place, where temples adjoin business houses and offices. In the market-stalls edging the forum were found charred nuts, fruits, and loaves of bread, left by the dealers in their flight, and a wall painting shows how pedlars of kitchen utensils and shoemakers traded in the forum itself

A short distance from the forum is a cluster of temples, and with them a great open-air theatre. Not far away is a smaller roofed theatre, the *palaestra*, where young men wrestled and threw the *discus*. In the near-by barracks of the gladiators were found armour and helmets



THIS DOG BARKED IN POMPEII

The ashes that buried Pompeii formed a sort of plaster mould, which preserved the outlines of this dog's body centuries after the body itself had mouldered into dust

and gladiatorial swords. Three public baths lie conveniently close to the forum and the *palaestra*

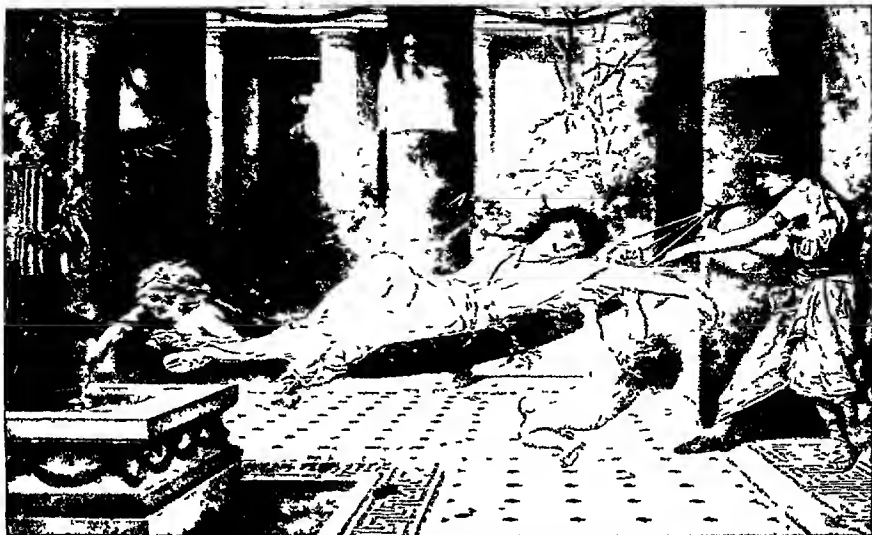
Of private life in ancient Pompeii the story is equally complete. The houses show a blank wall to the street, as Oriental houses and many in southern Europe still do. Once you enter the vestibule you see that the occupants got their air and sun light from a central court or a back garden. Opening out of the great room or *atrium* are the bedrooms—hardly more

than cupboards—the store room, dining room, and kitchen. In the kitchen is a raised hearth, on top of which burned the charcoal fire for cooking, and for heating the water for baths. A water system brought water for the bath and sometimes for a fountain in the atrium as well



A LOVELY HOME OF OLD POMPEII

This is a reconstruction of a house found among the ruins of Pompeii—the house of Pansa, it is called. Although it was the home of a Roman gentleman when the ashes of Vesuvius buried it in A.D. 79, it is one of the best examples we have of a Greek house, for the Romans borrowed their plans from the Greeks, and made only a few changes in style, such as the rounded arch of the doorway



A POMPEIAN MATRON SPENDS AN AFTERNOON AT HOME

The Pompeians did not overwork themselves, as you may guess from this painting. Not all Pompeian mothers, of course, could afford to have slaves to swing them all the afternoon, while their children played round them. But luxury was the prevailing note in this gay city, for Pompeii was a favourite resort of the more wealthy Romans.

Many thousands of smaller objects found in Pompeii have been taken to the museum at Naples, 13 miles away, for safe keeping. There you may see paintings, statues, mirrors, coins, pens and ink bottles, and even the very food that some of the Pompeians were having for lunch on the day of the eruption.

A few miles nearer Vesuvius lies Herculaneum, another Roman city buried in the same volcanic eruption. Excavation is much more difficult here, since the city is covered by 30 to 120 feet of hard rock-like lava, but tunnels have been sunk to the great theatre, forum, and some temples and private houses. The art treasures unearthed are far more valuable than those discovered at Pompeii. The most remarkable "find" is that of 1,800 rolls of manuscript.

Pompey the Great. (106-48 B.C.)

In the stormy times that marked the close of the Roman republic, Gnaeus Pompeius (Pompey), who was born six years before the great Julius Caesar, was one of the most celebrated of Rome's military leaders. In the civil war between Marius and Sulla he won such a brilliant victory over the Marian armies, in Africa and Sicily, that on his return to Rome he received the title *Magnus*, or "the Great." After a successful

campaign in Spain he was elected consul for the year 70 B.C. He espoused the people's cause, and repealed many of the hated laws of Sulla.

After the close of his consulship, Pompey was given supreme command in the Mediterranean and for 50 miles back from its shores—an unheard-of power. He rid the Mediterranean of the pirates who had long infested it, he subdued Mithridates, ruler of the kingdom of Pontus on the shores of the Black Sea, and Tigranes, king of Armenia, and captured Jerusalem and made Syria a Roman province.

His third "triumph" marked the turning-point in his career, for in political affairs he proved less able than in military. An alliance known as the first triumvirate was formed between Pompey, Crassus, and Julius Caesar, and Caesar gave his daughter Julia in marriage to Pompey. But after her death, and that of Crassus, the bond between Caesar and Pompey was loosened and jealousies arose. While Caesar was ruling the province of Gaul as proconsul, Pompey gradually lost influence.

Fearful of Caesar's power, he now returned to the Senate party. The inevitable conflict came when Caesar, refusing to disband his army at the command of the Senate, crossed the

Rubicon and marched to Rome This civil war ended with a complete victory for Caesar at the battle of Pharsalus, in Thessaly, in 48 B.C. Pompey fled to Egypt, where he was treacherously murdered

Poor, RELIEF OF No society is so simple that it does not contain some members unable to take care of themselves, and no society is so hard hearted that it is unwilling to take care of some of its dependants Orphans, the aged, the blind, the crippled, the feeble-minded, and the insane have always been dependent upon others

Christianity laid great stress on alms-giving as a religious duty In the Middle Ages, the Church was the great receiver and dispenser of alms In England, after the revenues of the Church had been diminished by the Reformation, the State began to take over responsibility for poor-relief In 1601 the Elizabethan Poor Law provided that in each parish overseers should be appointed with power to levy a poor rate for the support of the aged or infirm poor, provide work for the able-bodied, and apprentice young children to a trade In course of time "workhouses" or poor-houses were established in which the paupers might be compelled to live, but after 1782 the practice of paying poor-relief to able-bodied paupers in their own homes grew enormously A Royal Commission appointed in 1832 reported that the labouring classes in some districts were being demoralized by the easy way in which they might obtain incomes without working, and that the rates in many parishes were 20s in the pound What made matters worse was the practice of paying agricultural labourers very small wages and then compelling the rate-payers to make up the balance necessary to keep the labourer and his family alive This was called the Speenhamland system, as it originated in a decision given by the justices of this hamlet in Berkshire in 1795

As a result of the Commission's report, a Poor Law Amendment Act was passed in 1834, which appointed a Poor Law Board to supervise the poor law administration, and the workhouse system was reintroduced and made practically universal

Poor-relief becomes Public Assistance

In 1871 the Local Government Board assumed responsibility for the poor, and in 1919 came another change, when the Board's duties were taken over by the Ministry of Health In 1930 the Boards of Guardians, which for centuries had carried out the work of local administration, ceased to exist, and their powers were transferred to public assistance committees of the county and county borough councils There is now no "Poor Rate," but the cost of the public assistance services is collected through the general rate levied by local councils

Pope, ALEXANDER (1688-1744) Few men have triumphed over greater handicaps than did Pope, who became the foremost poet of his day He was sickly and had a deformed spine, and the intolerance of that day closed the better schools to him because he was a Roman Catholic But from his earliest youth, according to his own words, verse came to him with little effort He said that as a child he "bysed in numbers for the numbers came" The "numbers" took the form of the heroic couplet, which was then the prevailing verse form The following is an example

Know then thyself, presume not God to scan,
The proper study of mankind is man

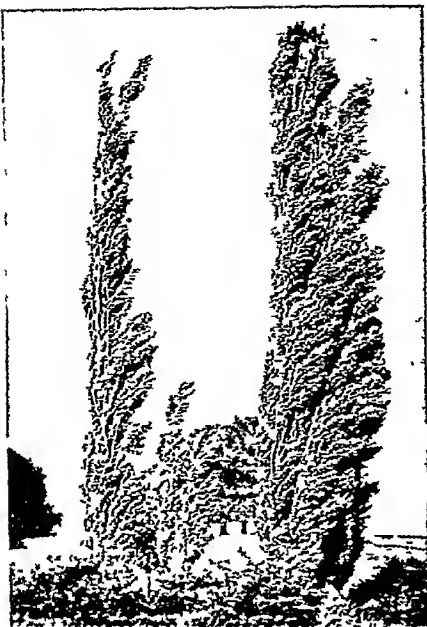
The first long poem which Pope published was the "Essay on Criticism" (1711) In it he expressed the common-sense ideas of his time on art in literature, in the most compact and highly-polished form yet seen in English In 1712 appeared 'The Rape of the Lock,' which tells in mock heroic style of the theft of a lock of hair from a belle of his own day By this time Pope was famous During the ten years following he was occupied with his translation of Homer into English verse

All Pope's work shows his mastery of epigram, of concentrated wisdom, but his "Essay on Man" is more quoted than any other partly because quotable couplets occur in greater profusion in it, and partly because it is the best expression of the philosophy of his which prevailed so widely in Pope's day, namely that "whatever is, is right"

Poplar. The poplar we all know is that tall, columnar tree, with flinty leaves, which sways so much in the wind that during a storm it looks as if it must snap off But resilience is one of the great features of the poplar's wood, and the Lombardy poplar, as this tree is called, seldom snaps in half although old trees are sometimes broken off in a really severe gale

The Lombardy is a variety of the true European black poplar (*Populus nigra*), which in England is not a common tree You can distinguish it by the very rugged trunk, covered with huge rounded bosses and warts, the whole bark being rough and deeply fissured like that of an oak This poplar is often a squat tree, with spreading branches that droop at the tips It comes into leaf fairly early, and this distinguishes it from the black Italian poplar, whose scientific name is *P. serotina*

The black Italian poplar—which does not come from Italy but is probably a hybrid between the true black poplar and certain Canadian species—is the commonest sort in England It grows, like most hybrids, very rapidly and to a great size, sending up a long, straight trunk with long, straight branches Its leaves



LOMBARDY POPLARS IN THE BREEZE

Though they are not natives of Britain the Lombardy poplars are familiar objects of our countryside and easy to recognize on account of their tall columnar form. Here the photographer has caught a row of them at their best in the breeze and strong summer sunlight.

tree more or less triangular, terminating in a less sharply marked point than those of the true black poplar or the Lombardy poplar, and it bears many long red catkins.

The grey poplar (*P. canescens*) on the other hand is almost invariably a female tree. It is another quick growing species, also exceeding a height of a hundred feet in some cases and having a very large bole. The leaves are dark green above and covered with whitish or greyish down below. This tree is usually called the white poplar on account of the colour of the under-sides of the leaves, but the real white poplar is a rarity.

You can tell the real white poplar (*P. alba*) by its leaves, which are usually quite deeply lobed and, when dead, retain their white down. In the grey poplar this down loses its

whiteness. Both these species send up suckers from their trailing roots which may be many yards long, and these suckers in turn become trees. The white poplar, however, seldom exceeds a height of over fifty feet, and the same may be said of the aspen (*P. tremula*).

The aspen is famous for the way in which its leaves tremble, for the stalks are flattened at right angles to the plane of the leaf-surface, so that they, as well as the leaves, catch the slightest breath of wind. The aspen is never very large and is often grown in a coppice, its wood being useful for various purposes. Its leaves are rather rounded, with a dentate margin (see Leaves), and while those on the main tree are small, those borne by the root suckers are usually very large.

The wood of poplars has remarkable fire resisting properties, and is therefore largely used for flooring, it is also used for boxes that have to undergo rough treatment, since it will dent rather than split when battered about, and the wood of the quick-growing species is valuable for paper-pulp.

Besides the species mentioned, many hybrids and other species from America and Canada are now grown in England, such as *P. balsamifera*, the balsam poplar.

Poppy. The garden varieties of the poppy have all been obtained by selection and cross breeding from different wild varieties, of which, perhaps, the ancestor of the opium poppy (*Papaver somniferum*) is the chief. The latter is probably a native of southern Europe and western Asia, but in Persia, India, and China



POPPY FLOWERS AND BUDS

The open flowers and buds of the common red poppy. The buds are bright red. The leaves are dark green and have a serrated margin. The flowers are large and have a deep red color. The buds are small and have a bright red color. The leaves are large and have a serrated margin. The flowers are large and have a deep red color. The buds are small and have a bright red color.

it has been extensively cultivated to produce the opium of commerce (*See Opium*). The seeds yield oil used in making paint and cheaper grades of salad oil. Many lovely types of poppy are grown in the garden, both for the herbaceous border and for the rockery. As they seed themselves freely, they reappear year by year without any trouble, once started.

The common scarlet or corn poppy (*Papaver rhoeas*), which grows wild in the corn-fields of Great Britain and the Continent (notably over the World War battle-fields of Flanders—hence our "Poppy Day"), is one of the most popular of all wild flowers, although to the farmer it is only a weed. The yellow Welsh poppy grows in mountain districts in Britain, while the yellow horned poppy—so called on account of its long seed-pod—is a well-known seaside plant.

Population. Man has increased more in numbers since 1800 than in all the uncounted centuries since our race first appeared. In 1800 it was estimated that the total population of the world was only about 700,000,000, to-day the total is nearly 2,000,000,000, and the increase still continues.

The primary cause of this increase is the advance in science. Improved agriculture and stock-breeding have increased the world's food supply, and the use of steam-power has multiplied a hundred-fold the product of Man's hands in the way of manufactures. Railways have opened up new countries with their tremendous agricultural possibilities, and steamships have reduced to a minimum the cost of carrying food. Science has largely conquered epidemic disease, and civilization has reduced tribal war. The annual death-rate in England and Wales fell between 1890 and 1930 from 19.5 per thousand to 11.4.

The increase of population has been greatest in the western world, but there are still as many people in Asia as in all the rest of the earth together. Europe possesses a quarter, and the remaining quarter is divided among North and South America, Africa, and the islands of the Pacific. Europe has on the average twice as many people to the square mile as has Asia. England, with an average of 742 to the square mile, is almost as crowded as Java,

the most thickly settled land of the Orient. But we must remember that England's population is chiefly industrial and derives its food largely from other countries, while Java is almost entirely self-supporting.

The white race forms about 40 per cent of the world's population—822,000,000. Against this is to be set the 1,140,000,000 of the "coloured" races, distributed as follows: the yellow race, chiefly in eastern Asia, 500,000,000, the brown peoples of southern Asia and northern Africa, 450,000,000, the blacks, chiefly in Africa, 150,000,000, and the Indians of America, 40,000,000.

Figures for Europe and other areas where birth statistics are accurately kept show that there are more boys born than girls, the excess ranging from 20 to 60 more boys in every 1,000

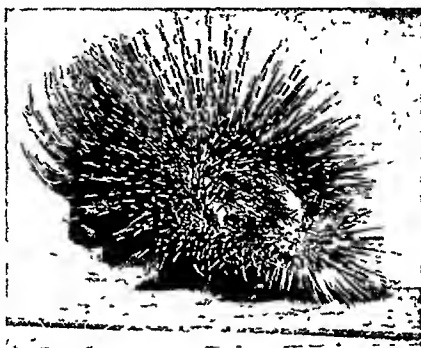
births. But more boy babies die than girls, and men are more exposed to death than women, so that in most highly civilized countries women come to outnumber the men. But in Asiatic and African countries, where the conditions of women's life are harder, their death-rate is higher and men apparently outnumber the women. On the whole there are slightly more men than women.

Porcupine. This large rodent is distinguished from all others by the sharp quills which it carries on its body and tail. Contrary to common belief, it cannot shoot its quills

at an enemy. When attacked, it erects them with a rattling noise and rushes backwards, being capable of inflicting serious wounds.

The true porcupines belong to the family *Hystriodontidae* and are found in southern Europe, Africa and much of Asia. During the day they hide in caves and burrows, coming out at night for food, which consists chiefly of roots.

Unlike the true porcupine, the American porcupines, which belong to the family *Erethizontidae*, and of which the Canadian porcupine (*Erethizon dorsatus*) is the chief representative, are climbers, spending most of their time among the trees. The porcupines of South America (*Syntherisma*) have long tails, with which they can grasp firmly slender branches, and shorter spines mixed with hairs.

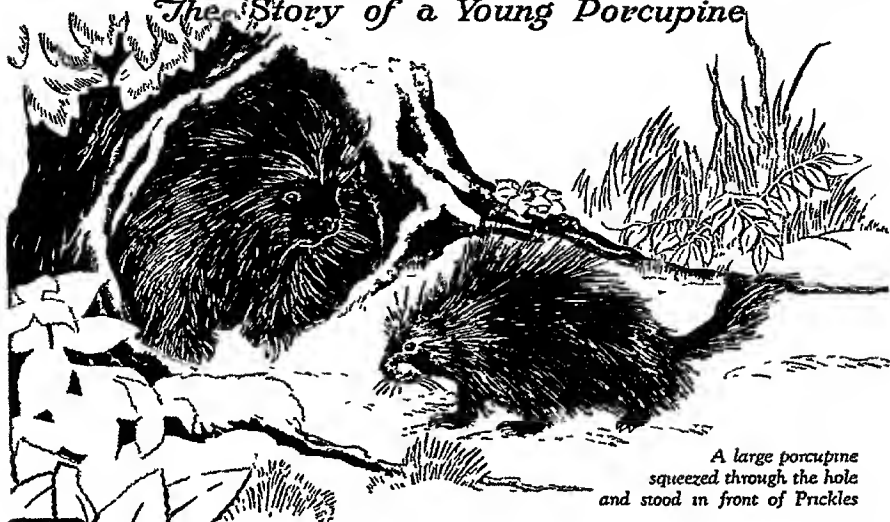


U. S. Berridge

PORCUPINE ON THE DEFENSIVE
The porcupine is well armed against its enemies, and this one is evidently expecting an attack of some sort, for its quills are erected in the most fearsome manner. No wise beast would attack "the fretful porcupine" when it is thus defending itself.

PRICKLES LEARNS to LIKE HIS QUILLS

The Story of a Young Porcupine



A large porcupine squeezed through the hole and stood in front of Prickles

P RICKLES the young porcupine, lived in a little cave by the edge of a wood. He was called Prickles because his back and sides were covered all over with long, prickly quills—white quills with black tips. Even his tail was covered with quills. His head was small and his legs were short and stumpy.

"Oh, dear!" he would often say to himself. "I wish I had nice soft fur like the squirrels. Fur would be much nicer than quills." But he could not change his quills, because all porcupines have them.

Prickles usually slept all day, but this afternoon he was very hungry. So he got up bright and early to look for his breakfast. There was plenty of bark on the trees for him to eat, but he was tired of eating bark. There were plenty of nice juicy twigs, but he was tired of eating twigs, too.

"I wish I could find something new to eat," he thought, "something I have never had before."

All at once he saw a dark hole under the roots of a big tree. "I wonder what is in that hole," thought Prickles. He went a little nearer—something moved inside the hole. He went still nearer—two small eyes looked out at him.

"Oh!" cried Prickles. "Who are you? What is your name? Do you live here?"

The two eyes blinked back at him for a moment and then, very slowly, a large porcupine squeezed through the hole and stood right in front of Prickles.

"You ask a lot of questions," said the porcupine, "but that's all right. You are young and you have many things to learn. My name is Old Quills," he went on politely, "and this is my den. I usually sleep through the day and hunt at night."

"I have a den, too," said Prickles, "but it is smaller than yours. Have you lived here long?"

"I have lived here a long time, little porcupine," answered Old Quills, "for I am very old. I have seen six summers and six winters."

"My!" said Prickles, "you are old, aren't you?"

Old Quills shuffled slowly off to look for his breakfast, and left Prickles standing all alone.

"Wait a minute!" cried Prickles. "I want to go with you!" He couldn't walk very fast because his legs were so short, but he walked as fast as he could. A saucy chipmunk scurried past him and called back, "What a slow walker you are, porcupine! Don't you wish you could run as fast as I can?"

PORCUPINE

Prickles knew he was slow, but he couldn't go faster, no matter how hard he tried. So he just walked on and didn't answer the chipmunk, but his feelings were hurt. Pretty soon he saw Old Quills waiting for him by a hemlock tree.

"Come along, little porcupine," said Old Quills. "I will show you where there are a lot of fine lily pads. They are tender and green and very good to eat."

"Oh, good!" cried Prickles. "I am so hungry that I could eat them all!"

As they shuffled along on their stumpy legs, the little creatures of the woods peeped out from their nests and burrows to look at them.

"See the clumsy porcupines!" said a rabbit. "Did you ever see such awkward creatures in all your life?"

"Shhh!" whispered a squirrel. "They might hear you and stick you full of quills!"

"Pooh," laughed the rabbit, "they won't hear me. Porcupines can hardly hear at all. Anyway, I am too fast for them!"

At last Prickles and Old Quills came to a little pond covered with the loveliest lily pads. "Here is our breakfast," said Old Quills, pulling out a lily pad and munching it slowly. "There is enough here for both of us, and more too!"

"I am going to eat all I can hold," said Prickles. "My! they look good!"

He grabbed the nearest one in his mouth and ate it greedily. Mmmm—it was tender and juicier than

anything he had ever eaten. He ate another, and then another. How good they were!

Then Prickles saw the biggest lily pad of all. It was round and green and smooth, and he wanted it very much.

"Maybe if I stretch hard, I can reach it," he thought. So he leaned out as far as he could and tried to seize it with his sharp teeth. The big lily pad was just out of his reach. He leaned out a little farther and—splash! he fell right into the water!

Prickles was so frightened that he splashed and kicked with all his might. "Old Quills! Old Quills!" he called, when he finally caught his breath. "Come quick and help me out!"

But Old Quills just stood on the bank and chewed his lily pads.

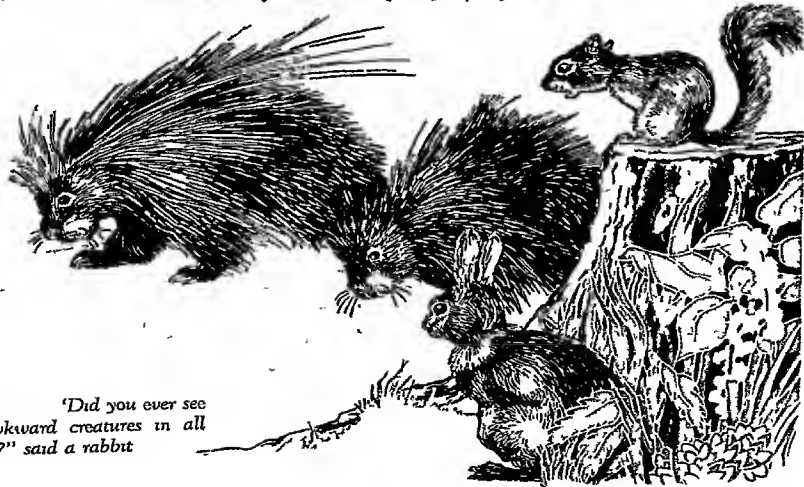
"Don't be frightened, little porcupine," he said. "Your hollow quills will keep you up and make you float like a piece of wood. We porcupines don't have to swim if we don't want to," he added proudly. "We just float!"

Prickles stopped his splashing and kicking and, sure enough, his quills held him up, just as the old porcupine had said!

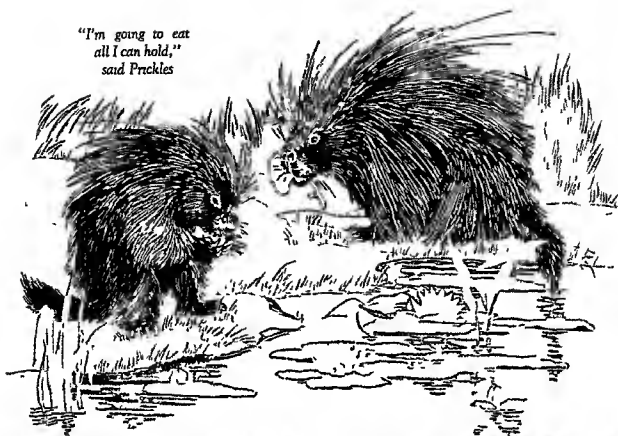
"What fun it is to float about on the water like this!" thought Prickles. "I like to float," he said aloud, "it is great sport!"

"You had better get out of the water now, young porcupine, if you want to come with me," said Old

"Did you ever see such awkward creatures in all your life?" said a rabbit



FORCUPINE



Quills "I am going to my hemlock tree up on the hill "

"Oh, I do want to go with you, Old Quills!" cried Prickles, as he paddled to the shore "Please wait for me!"

So the old porcupine waited until Prickles had mbed out on the bank.

"Now then," said Old Quills, "let us go!"

"Ha! Ha!" screamed a bluejay, as the two porcupines shuffled clumsily along "Look at the funny porcupines! They can't fly or run They can't even walk very fast "

"I don't like to be made fun of," little Prickles said to Old Quills "I know I can't walk fast and I know I look clumsy, but I wish the other creatures wouldn't laugh at me "

"Don't pay any attention to them," said Old Quills, "we porcupines can do some things that they can't do "

"What?" asked Prickles

"Well, we can float for one thing," said Old Quills "Yes, and that's fun, but we can't run like the unreels and chipmunks," said the little porcupine They think we are slow and clumsy "

"We don't have to run," replied Old Quills "Other creatures run when they smell danger, because they are afraid We aren't afraid of anything, because we know how to protect ourselves "

"How do we protect ourselves, Old Quills?" cried Prickles eagerly "Tell me, won't you?"

"It's very simple," the old porcupine said "Your sharp quills are your weapons You haven't any quills on your nose, so if a creature tries to harm you, turn your back to it, put your nose between your forepaws, and then thrash about with your tail as hard as you can If the creature tries to touch you then, he will get his nose stuck full of your sharp needles That will teach him to leave you alone, because a nose full of your needles hurts Most creatures have learned not to bother us "

"Oh," said Prickles, "then we are as clever as the other forest creatures, aren't we? Is there anything else we can do?"

"Yes," said Old Quills, "there is another thing "

"What is it? What is it?" cried Prickles

"Well," said Old Quills, "whenever I get sleepy or tired I crawl into the first little hole I see and curl up with my prickly back in the mouth of the hole I won't be bothered, because if any other creature tries to get into the hole, he gets stuck with my quills "

"Oh," cried Prickles, "I want to try that!"

"You will have to find a hole first," said Old Quills "I am going to my hemlock tree at the top of the hill There is nothing I like better to eat than bark and twigs, and that hemlock tree has the most bark and twigs in the whole forest "

While Old Quills climbed slowly up the hill, Prickles looked around for a hole to sleep in

"I guess there are no holes in this hill," he thought, after he had looked and looked "What shall I do? I am so tired and sleepy"

Just then Prickles saw something black a little farther up the hill "It looks like a fine sleeping hole," he said "Hurray! There's just room for me" He crawled into it as fast as he could and put his prickly back right up against the opening

"Now nobody can bother me, or make fun of me," he thought "I can sleep just as long as I want to"

By and by he was awakened by a noise outside He couldn't see out, but he knew from the grunting noise that it was a young groundhog

"What do you mean by lying in my hole!" the groundhog scolded "The very idea! Come out this minute!" But Prickles lay very, very still The young groundhog tried to push his way in Foolish groundhog!

"Oh me! Oh my!" he cried "What have you done, porcupine! You've stuck me full of quills My poor nose! My poor nose!"

"Oh, I'm sorry, groundhog," said Prickles "Why weren't you more polite? You should have known better than to push a porcupine about"

"I will surely know better the next time," said the groundhog, as he tried to pull the quills out of his nose "I will never make fun of a porcupine again as long as I live"

"You may have your hole now," Prickles said "I've had a good sleep and I must go and find Old Quills Goodbye, I'm sorry I hurt you" The ground-hog didn't answer He was too busy rubbing his nose

Prickles had not gone far before he saw Old Quills coming toward him "Did you find a hole, little porcupine?" Old Quills asked

"Yes," said Prickles, "I found a groundhog's hole He came home and started to push in When I left him he was busy pulling my quills out of his nose"

"Ho—ho!" chuckled Old Quills "You are learning fast All the creatures will soon learn not to make fun of you And now let's go home You have had an exciting day for a little porcupine, and we have a long walk"

So Prickles and Old Quills started home Prickles was very happy

"I would rather be a porcupine than any other creature in the forest," he told Old Quills, as they shuffled along "Porcupines can do so many things"

"You should have known better than to push a porcupine about"



PORPOISE

Porpoise. (Pron por'-pos) The true porpoise which is distinguished from his first cousin the dolphin (see Dolphin) by a blunt snout, instead of a sharp beak-like nose is one of the friendliest of this group of sea creatures. He usually lives along the sea coast, and often swims into rivers and harbours to show off sometimes throwing himself completely clear of the water, and coming close to the pier or to boats.

The porpoise (*Phocaena communis*) is not a fish. It is a mammal like the whale, to which it is distantly related. Like the whale, also, it has tiny ear openings and a single nostril or "blow-hole," which is opened during the animal's frequent trips to the surface for air. The tail is horizontal, not perpendicular like the tail of fishes. Two "flippers" serve as fore-limbs, and most species have a fin on the back. There are about 40 teeth in each jaw. The body is black on top and white underneath.

Porpoises are common on the coasts of the North Atlantic and are often seen in the English Channel, where their chief food consists of mackerel and herring. Their thick hide is sometimes made into soft leather and their fat yields oil of specially fine quality. (See Whale)

A particularly interesting relative of the porpoise is the narwhal (*Monodon monoceros*). In the male narwhal one of the teeth, usually of the left upper jaw, projects forward in a long straight tusk, about half the length of the body. The full-grown narwhal has a body about 16 feet long. Narwhals are found chiefly in the Arctic Ocean.

Portland Bill. If you look at the map of England you will see, jutting out from the coast of Dorset, a curious little peninsula separated from the mainland by a "neck" so narrow that it seems as though the sea must at times sweep over it. This is Portland Bill, sometimes known as the "island of Portland," and, in the "Wessex Tales" of Thomas Hardy called the Isle of Slingers.

At one time there was a large prison at Portland—it is now a reformatory—and the prisoners spent their time working in the quarries from which came the famous limestone known as Portland stone. It was said, in fact, that "London was paved with Portland stone"—indeed, not only paved, but in many

PORTSMOUTH

parts actually built of it. St Paul's Cathedral and the Cenotaph in Whitehall are two of our great national monuments which have come from that little area of Dorset.

By reason of its curious shape Portland has a fine natural harbour, and this helps to make it one of the most important naval bases on the south coast. To the west, too, stretches for over 15 miles the famous Chesil Beach, one of the longest shingle beaches in the world, and one of the most interesting parts of all our shores. Within it, a lagoon—the Fleet—contains the Abbotshury swannery.

Portsmouth. Britain's greatest naval station and arsenal is situated in Hampshire, on Portsea Island, which lies, in turn, between Portsmouth Harbour and Langstone Harbour.



PORTSMOUTH'S FINE GUILDHALL

No visitor to Portsmouth can fail to be impressed by the large Guildhall which stands at the corner of Park Road and Commercial Road, adjacent to the handsome war memorial. The Guildhall, seen above, was built in 1890. It is in the classical style with a large flight of steps leading up to the colonnaded portico. The fine clock tower which surmounts the building is 240 feet high.

The borough, created a city in 1926, consists of five parts. Portsmouth proper and Portsea comprise the naval station, Landport is the workmen's section, Southsea is a popular watering-place and residential quarter, and Cosham is chiefly devoted to agriculture. Gosport, on the western side of the harbour, is reached by ferry.

Long before 1540 Portsmouth was important as a naval station and trading centre, but it was about that date that the Royal Dockyard was regularly established, with an area of about eight acres. By the end of the 18th century this area had increased to 90 acres. Greatly extended in the 19th century, the dockyard now has an area of more than 300 acres, with ten miles

of railway Here the largest battleships can be built and repaired On Whale Island, to the north of the dockyard, there is a naval gunnery establishment H M S Victory, Nelson's flagship at Trafalgar, has now a permanent home in the dockyard, and is used as a Nelson Museum

Portsmouth is now connected with London by a fast electric train service and an important

trunk road To the Isle of Wight, across Spithead, are run frequent steamers and air services

The church of St Thomas (now the cathedral) is a fine building, parts of which date from the 12th century The Star and Garter and the George Hotel (where Nelson spent his last night ashore) are rich in naval memories The population of Portsmouth is 249,000

PORTUGAL, OUR OLDEST ALLY

Though a small country—some think of her as a mere appendage of Spain—Portugal has a great history and a mighty empire that bear witness to the energy and courage of her earlier inhabitants

Portugal. Like Great Britain, her ancient ally, Portugal is a small country with far-flung colonial possessions, which are twenty-seven times the size of her own country even today

Great as these colonies are, they are only a small remnant of the once glorious empire that Prince Henry the Navigator began building in 1412, when he encouraged expeditions to press farther and farther down the western coast of Africa to annex now territory Portugal colonized the Canary Islands, Madeira, and even the Cape Verde Islands Then, about 1460, the year of Prince Henry's death, the Azores, too, came into Portuguese hands Still more glorious advances remained for the end of the century, when Vasco da Gama sailed round the Cape of Good Hope and reached India, and other Portuguese navigators, seeking to avoid the coastwise currents of Africa, accidentally discovered Brazil in the year 1500

By the middle of the 16th century all trade from the Straits of Gibraltar to Canton, China, was under Portuguese control Throughout all this distance Portugal had an almost unbroken line of trading-posts, and to protect herself from the jealousy of other nations she made these posts military stations as well Brazil alone, little thought of in those days, became an agricultural colony of peaceful settlement, to which Portugal sent what she considered her undesirable citizens

What Portugal had most to fear was her warlike next-door neighbour—Spain, six times her own size There is no natural boundary between the two countries and the rivers and mountains of Portugal are almost all carried over from Spain (See map under Spain)

Extent—Area, 34,254 square miles (35,490 square miles including Azores and Madeira) Colonial possessions (Cape Verde Islands, Angola, Mozambique, Guinea, etc.), nearly 950,000 square miles Population (continental Portugal), about 6,800,000

Physical Features—Much indented Atlantic coast-line forming the west and south boundaries, numerous mountain ranges in the interior separated by river valleys (highest range, Serra da Estrela, about 6,530 feet) Principal rivers Minho, Douro, Tagus, Guadiana

Products—Wheat, maize, rye, oats, barley, beans, potatoes, and other vegetables, figs, lemons, and other fruit, olives and olive oil, grapes and wine, sardines and tunny, iron, tin, tungsten, and coal, cork, woollen and cotton textiles, porcelain tiles and other pottery

Chief Cities—Lisbon (capital, about 594,000), Oporto (322,000), Coimbra, Evora

Northern Portugal continues the high central table land of the Iberian peninsula The valley of the Douro, where the river flows along a ravine over a thousand feet deep, on either side of which rises terraced after terraces of vines, is one of the richest wine-producing regions of Europe This vine country, extending for more than 30

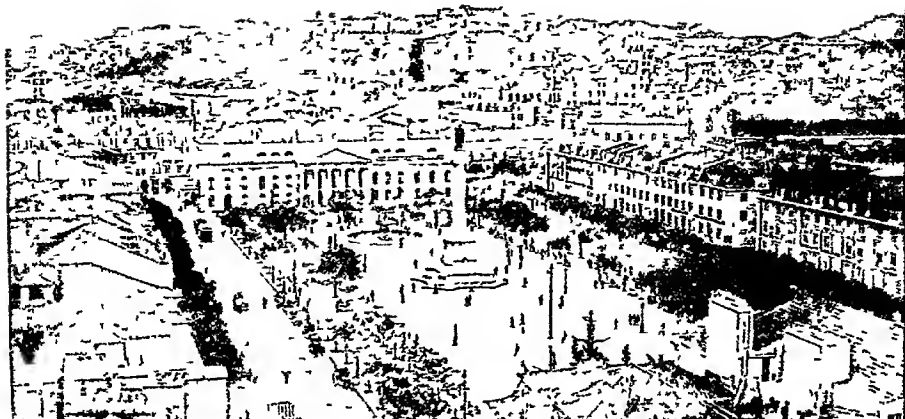
miles along the river, has as its market city Oporto, near the mouth of the river, and it is from Oporto that the wine of the district takes its name, "port"

Central Portugal, especially Estremadura, the province in which Lisbon (q v) lies, is to a certain extent barren country, grazed by sheep, goats, and pigs In the province of Alentejo is the centre of the cork industry The extreme south of Portugal consists of the tiny province of Algarve, a garden country like the most fertile parts of Andalusia in Spain, where grows fruit in abundance—oranges, figs, almonds, olives, chestnuts, grapes, and the pulpy carob beans Here also the fishermen draw from the sea rich catches of sardines and tunny

Though agriculture is the chief industry, many foodstuffs are imported Increasing production of wheat however, has lessened dependence on other countries for grain There is a large export market for tinned sardines, as well as for wine and cork The leading manufactures are textiles, porcelain tiles (*azulejos*)—an industry inherited from the Moors—shoes, and paper

The Portuguese peasants have many feast days and pleasant customs, connected with summer pilgrimages and saints' days and the secular festivities of sheep-shearing and corn-threshing At such times you will hear a rich store of songs, proverbs, and folklore, and plenty

PORTUGAL



LISBON FARTHEST WEST ON THE CONTINENT OF EUROPE

Lisbon, the capital of Portugal, is situated on the promontory which marks the westernmost point of continental Europe. The view we have here shows the Square of Dom Pedro IV—famed the world over for the wavy pattern in its mosaic pavement. In the centre of the square is a monument to Pedro IV—the last king of Portugal who was also Emperor of Brazil. At the far end is the handsome national theatre, named in honour of Queen Maria II, daughter of Pedro. While Lisbon has many such beautiful spots, the poorer quarters are exceedingly squalid and ill-built.

of tales of ghosts and witches. The costumes are quite picturesque, especially when the women go to town dressed gorgeously in red with gold ornaments and necklaces almost covering the bodice.

Portugal has three universities—at Lisbon, Coimbra, and Oporto. Of these, Coimbra University is the oldest, having been founded as long ago as 1290. In literature she claims a place by reason of her 16th century poets, especially Luis de Camoens (c. 1524–1580), whose *Lusiads*, commemorating the exploits of his fellow countrymen ranks among the world's greatest epics.

The early history of Portugal is much like that of Spain, except that the successive conquests of Carthage, Rome, and the Moors all penetrated to this remoter part of the peninsula in a weaker form, and that Portugal has been a maritime

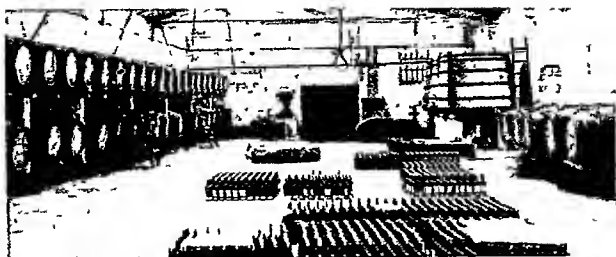


SHOES ON HER HEAD!

The peasants of most lands have to practise economy in some form or another, but few go as far as the Portuguese peasant girl seen above, who is preserving her shoe leather by carrying her shoes where other people wear hats!

country from the beginning. It was partly reconquered from the Mahomedans by King Ferdinand I of Castile in the 11th century, who made it the *Terra Portucalensis* (from *Portus Cale*, a suburb of Oporto). It became independent of Castile and a kingdom in 1140. In 1580 the royal family of Portugal died out, and Philip II of Spain by force of arms seized the crown. Sixty years later (1640) Portugal emerged a free country, but shorn of almost all her great colonial empire.

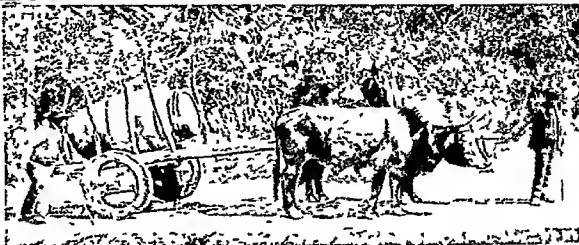
In 1703 the famous Methuen Treaty confirmed the alliance of England and Portugal that dates from 1386, the oldest existing alliance in European history. When Napoleon overran the Spanish peninsula in 1807, the Portuguese king and royal family fled to Brazil. The British under Wellington proceeded to clear the



peninsula of the French in what is known as the Peninsular War (1808-14). But the Portuguese king did not return until 1820, and then Brazil became an independent empire under his son, putting an end to Portuguese power in the New World.

A revolution made Portugal a republic in 1910. King Manoel II being dethroned. Internal strife persisted until a military dictatorship took control in 1926. Meanwhile the country's finances went from bad to worse until Antonio Salazar, a university professor, was appointed Minister of Finance. His success in improving the financial system brought him the post of Prime Minister in 1932. A change from military to civil dictatorship resulted, with Salazar as the leading spirit. A new constitution, adopted in 1933, established Portugal as a corporative state, modelled in some respects on Italy. It provides for a President, a Cabinet, a National Assembly, elected half by popular vote and half by economic corporations, and a Corporative Chamber. A 15-year plan was formed which provides for economic reorganization and building up of the national defence.

Poseidon. (Pron pō-sī'don). In the days of ancient Greece, Poseidon, god of the sea, was supposed to dwell in his golden palace in the depths of the Mediter-



PORT WINE PRODUCE OF PORTUGAL

Like most of the agricultural equipment in Portugal, the peasant's ox-cart, often used for hauling barrels of wine, as shown in the photograph above, looks as if it had been handed down from generation to generation for ages. In contrast is the air of efficiency of a bottling room of Messrs. Sandeman, the port wine shippers, at Douro (top).
Top photo courtesy of Geo. F. Sandeman Sons & Co. Ltd.



POSEIDON, GOD OF THE SEA
In the National Museum at Athens stands this fine cast of Poseidon, copied from a famous statue of the 4th century B.C. Poseidon was identified by the Romans with Neptune.

anean. The Nereids and Tritons attended him when he rode in his sea-shell chariot. Dolphins played about his car, and at its approach the restless waters grew calm.

In his hand Poseidon carried his trident, a three-pronged spear, the symbol of his power. With one stroke of this the mighty sea god could shatter rocks, cause earthquakes, call forth

storms, or lash the sea to such fury that the very earth shook with the beating of its waves. Mariners prayed to him as the giver of calms and of favouring winds, and in his honour erected temples on jutting headlands, and made sacrifices of rams and of great black bulls, symbolical of the storm-swept sea.

But for all his power, Poseidon was subject to the will of his brother Zeus, who was king of gods and men, and by whom he was once condemned to live for a year on earth among mortals.

It was at this time that Poseidon agreed with Laomedon, king of Troy, that for certain rewards he would build that city's mighty wall. He built the wall, but received no reward. Poseidon nursed his vengeance until the Trojan War. In that long-drawn-out conflict waged between the

Greeks and Trojans, Poseidon was always on the side of the Greeks, helping and encouraging them until at last the city lay in ruins. But on the return voyage of the Greeks to their native land Poseidon was hostile to Odysseus (Ulysses) and helped to cause the ten years' wanderings of that much-enduring hero (See *Odysseus*). The Greeks believed that Poseidon was the son

of Kronos and Rhea, and was the brother of Zeus and Hades, who ruled the world of earth and the underworld of the dead, as Poseidon ruled the sea. The Romans identified Poseidon with their god Neptune "King Neptune" generally takes part in the comic ceremony of "crossing the line" practised on board ship when crossing the Equator (See page 2445)

AMAZING ADVENTURES of a LETTER

In this article is told what happens to a letter from the moment it is dropped into the pillar-box until it is delivered in perhaps some remote corner of the globe. Many of the other activities of the Post Office are also described.

Post Office. There is a "rat tat-tat" at the front door. It is the postman on his morning rounds, bringing you tidings good or



bad. He is the modern courier—the very day symbol of a system which has evolved through nearly two thousand years.

Under the ancient Persian Empire there was a regular system of dispatch-riders or State carriers, but the germ of the modern postal system is perhaps to be sought in the organization in force under the Roman

Empire, when official letters were transmitted from stage to stage by couriers between Rome and its provinces. The University of Paris at about the end of the 13th century established for the use of its students the first postal system in France. Later a courier system was established by Louis XI.

In England private posts existed from the time of Edward III, and a royal messenger service, out of which the postal service developed, even earlier. The first "Master of the Posts" in England was apparently in office by the year 1512. The service, originally only for State dispatches and the like, was extended from time to time, but was not consolidated into one establishment until 1710, when a General Post Office for the British dominions was set up in London under the control of the Postmaster-General. Nine years later came the first of the reforms instituted by Ralph Allen, Postmaster of Bath, who was the first to interconnect towns on the main postal roads to London. The mail coach system, begun in 1784 by John Palmer, lasted half a century, but entirely died out with the advent of railways.

A great advance was made as the result of the efforts of Sir Rowland Hill, who introduced

uniform penny postage and the adhesive postage stamp in 1840. Before his time postage was paid in money by either the sender or the receiver, and the rate varied with the distance as well as the weight, so that a letter within the limits of England often cost as much as a shilling postage. The chief features of the reform were the uniform rate irrespective of the distance, and the reduction of the minimum postage to one penny.

Today you post a letter to a friend hundreds of miles away across the country, in a couple of days you have a letter back and think nothing of it. Yet behind this apparently simple event lies the vast, efficient organization of the British Post Office which delivers 25,000,000 letters a day.

'Side-lines' of the Post Office

The collection, dispatch, and delivery of mails is only one part of the "P O's" work. It operates the telephone and telegraph services (see separate articles), sells insurance and unemployment as well as postage and other stamps, issues dog, wireless, and certain other licences, supplies and cashes postal and money orders, pays old age and other pensions, runs its own Savings Bank and does a huge business in National Savings Certificates. When we consider these manifold activities we begin to realize why the Post Office has the gigantic annual turnover of £900,000,000.

Let us follow the adventures of the letter that you have just posted to one of your friends. First of all it is collected at a certain stated time from the red pillar-box by the local postman, who takes it with the rest of the collection to the nearest sorting office.

Here the postmen's bags are emptied on a big table, known as the "facing table," where the correspondence is separated into three classes. These consist of "short letters" (those of ordinary size) and postcards, "long letters", and newspapers and packets. All the letters pass on to the stamp-cancelling machine, where your letter is duly postmarked and is then ready for sorting. The work of the sorters

POST OFFICE

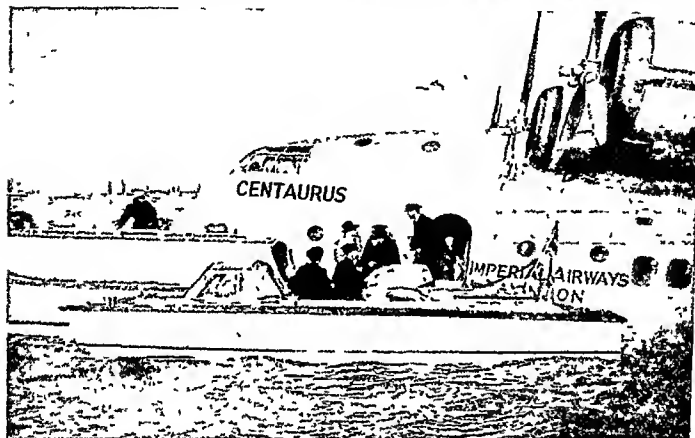
is made much easier if each letter is correctly addressed and stamped.

The primary sorting table comes first, here all the letters are sorted into direct selections for large towns or into divisions or "road" groups of counties including that to which your letter is addressed. At the secondary table further sorting is done, and your letter is sorted for dispatch to the distributing office nearest to the office of delivery.

Registered letters are dealt with in a special part of the sorting office. Parcels, of course, are dealt with in a separate office in the largest towns, but are sorted in much the same way

These Royal Mail expresses, as well as the ordinary express trains to which T.P.O. carriages are attached, have no time in which to stop at every station on their route and so an ingenious device known as the mail-bag exchange apparatus is used at no fewer than 115 points on British main-line railways. While the train is moving at full speed, and without any interruption of the work on board, mail-bags, enclosed in leather pouches and addressed to the T.P.O., are caught up by a net projecting from the side of the carriage, while other bags dispatched from the T.P.O. are caught in a net by the side of the track.

Suppose now that your friend lives beyond the other side of London and that your letter has to pass across that city. The bag containing the correspondence addressed to your friend's town may be placed on the Post Office Railway, a unique feature of the London postal service. This is a mail-carrying railway that practically "runs itself" for 6½ miles beneath the heart of Central London. The trains carry no drivers or guards—in fact, nothing but letters and parcels. The Post Office Railway runs from Paddington Station in the west to the Eastern District Post Office at Whitechapel, stop



FLYING LETTERS TO FAR-OFF LANDS

Thanks to the service of Empire flying-boats run by Imperial Airways, delivery of letters to the farthest points of the Empire has been greatly speeded up. Above, we see mails being loaded on to the flying-boat Centaurus on Southampton Water. All letter-mail for those parts of the Empire lying on air routes now goes by aircraft as a matter of course.

Courtesy of British Power Boat Company

as are letters. There is often a "hospital" attached where experts retie and rewrap parcels that have come "unstuck."

Our letter now leaves the sorting office and may be sent with hundreds of others in a mail-bag to a travelling post office, in which further sorting is carried out. Travelling post offices are specially-constructed railway carriages—in effect, sorting offices on wheels—which are attached to certain trains on almost every trunk railway line in the country. Perhaps the particular "T.P.O." carries our letter to a station where one of the "all-mail" expresses halts during its dash through the night. There are four of these famous "Special T.P.O." trains, running between London (Euston) and Aberdeen, and London (Paddington) and Penzance.

ping at six other stations, including those at Mount Pleasant and at the London G.P.O. (King Edward Building), the biggest sorting offices in the Empire.

The bag containing your letter may be transferred at some point from the Post Office Railway to one of the familiar red mail-vans and taken across London to the station of departure by whatever method it travels, however, it will only be a short time before it is loaded into an ordinary train for its last railway journey.

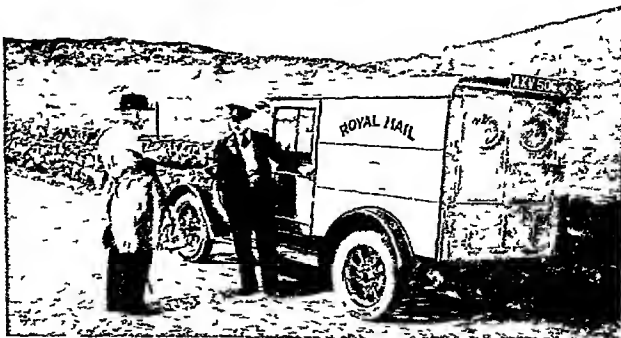
Arrived there, the bag goes to the local sorting office, where what is known as the "inward" sorting begins. Each letter eventually finds its place in the order worked out by the postman responsible for delivering it on his "walk." An hour or so later, your friend

FROM PILLAR-BOX TO LETTER-BOX



These photographs enable us to follow a letter to its destination (1) Postman clearing a street pillar-box in London. The letters are taken to the post office to be sorted (2) Inside a sorting office showing the facing table and in the centre an up-to-date stamping machine (3) Letters en route for their destination sorting mails in a travelling post office on the train (4) Mail-bag apparatus for gathering and delivering mails while the train is travelling at full speed (5) Last stage delivering mail by motor van in a lonely region of North Wales

1 Photos reproduced by courtesy of the Postmaster General



POST OFFICE

receives the letter at his front door, and its long journey is over.

Postage rates in force within the United Kingdom since May 1, 1940, are 2½d for a letter (when not exceeding 2 ounces in weight), 2d for a postcard, and 1d for a "printed paper." To Egypt and certain Empire countries the letter postage rate is 2½d not exceeding 1 oz., postcards 2d, to the other Empire countries and the United States of America the rate is 2½d for the first ounce and 1d for each additional ounce, postcards 2d, and to all other places abroad 3d for the first ounce and 1½d for each additional ounce, postcards 2d. Simple greetings on a picture card can be sent anywhere for 1d.

The largest post offices at home and abroad have a "poste restante" service for the convenience of travellers, whereby correspondence can be addressed to the post office to be called for. Another example of "P.O." enterprise is the "greetings" telegram, designed to be sent on occasions such as weddings or birthdays.

Sending Letters by Air

The Post Office is fully alive to the necessity for taking advantage of the greater speed afforded by air as compared with surface transmission and ever since the first regular international air mail service in the world (London-Paris) was inaugurated in 1919 development has been rapid. The greatest advance in British air mail services came with the progressive opening up of the Empire air routes to South Africa and Australia.

In June 1937, the first stage of the Empire Air Mail Scheme, which has been devised to provide improved accelerated, and more frequent services on the Empire routes between this country, India, Australia, and South Africa, was introduced on the route to South Africa and all letters, letter-packets and postcards for Empire countries in East and South Africa are now forwarded by air as the normal means of transmission at the postage of 2½d per half ounce. These arrangements were extended to Empire countries served by the England-India Malaya-Australia line in 1938.

A similar scheme is now in force as regards correspondence to most of the countries on the European continent. There are also a few air-mail services within Britain.

Regulation of International Posts

Between nations, the exchange of correspondence is governed by the Universal Postal Convention of the Universal Postal Union, which was founded at Bern, Switzerland, in 1874. All countries, except a few unimportant territories, are included in the Union. The British Post Office is a Government Department under the control of the Postmaster-General (P.M.G.).

The Post Office offers a number of positions to both men and women. Under it are the

POTASSIUM

officials at the headquarters in London and those employed in the various post offices throughout the country. Some are engaged in the postal service itself, while others serve in the telegraph or telephone departments. All the employees of the Post Office are civil servants, permanent or temporary.

Getting a Job in the Post Office

Some of the positions in the Post Office are obtained in exactly the same way as those who enter other departments of the Civil Service. These include members of the administrative executive, and clerical classes and writing assistants. The majority, however, are recruited especially for work in the Post Office and many of these enter as the result of competitive examinations that are open to all. A few posts, for which special professional qualifications are needed, are recruited by selection or by competitive examination confined to nominated candidates. Four of the most numerous classes in the Post Office are postmen, sorters, telegraph operators, and telephone operators. The Post Office offers a great deal of employment, in its telegraph and telephone branches, to engineers.

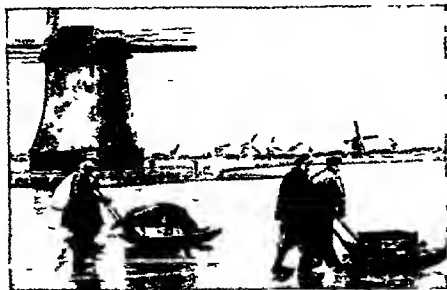
Potassium. Man could get along without silver and gold, but without potassium, life whether of plants or animals, would be impossible. Yet this element is never found alone, and to wrest it from its compounds in payable amounts is a difficult task. No one had ever seen it until, in 1807, Sir Humphry Davy obtained it from fused potash by electrolysis.

Potassium belongs to the group of alkali metals which includes sodium, lithium and the rarer rubidium and caesium. All these form compounds so readily that in the laboratory they are kept under oil to exclude moisture and oxygen. When potassium comes into contact with water it reacts violently, seizes the oxygen and part of the hydrogen to form potassium hydroxide, and generates so much heat that the left-over hydrogen bursts into flame and in burning becomes water again. Potassium is one of the few common elements which are radio-active (See Radium and Radio activity).

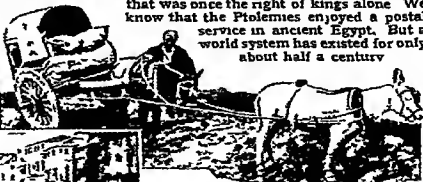
The original source of the caustic potash used in making glass and soap was the lye produced from plant ashes, boiled in a pot, hence the name "pot ash" but the world needs vastly more for use as fertilizer than could be produced in this way. Although potash compounds are plentiful in Nature most of the potassium is locked up in insoluble silicates in the rocks. The "weathering-out" process releases them into the soil, but too slowly to meet our needs. So the supply must be artificially increased.

With the exception of some silicates most naturally occurring potassium compounds are soluble in water. Rains dissolve them from

ROUND THE WORLD WITH THE POSTMAN & HIS BAG



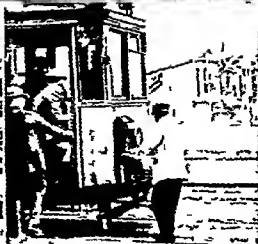
The letter with a foreign address which you drop in the pillar-box may reach its destination in the strangest sort of conveyance. If it arrives in the Netherlands in midwinter, the postman, in wooden shoes may push it on a hand sledge over the frozen dykes, past creaking windmills, as we see in the picture on the left. The Chinese postman, below may follow a route even more difficult. He may drive a team of little donkeys pulling a two-wheeled primitive cart over rough and muddy roads if he delivers letters in the rural districts. China was last to join the great postal union which binds the world together and gives the humblest citizen a power of communication that was once the right of kings alone. We know that the Ptolemies enjoyed a postal service in ancient Egypt. But a world system has existed for only about half a century.



Slashing the blue-green waters of the canals of Venice go the speed boats of the *Poste Ita'hane*, carrying letters to the watery doorsteps of the Venetians. The letters are locked in gay striped bags of the Italian national colours, red, white and green. Only the postal boats and the Red Cross boats to rescue the drowning are allowed to use motors in the small quiet canals where the black gondolas glide smoothly along. On the left we see a post launch on the Grand Canal setting out early while traffic is still light.



Although the people of India average less than 4 letters apiece each year the sandal-shod feet of the Indian postmen carry about 1,000,000,000 letters over the hot and dusty roads of this vast country each year. India has practically the same postal rates as Great Britain or the United States and has a parcel post service and a money-order system which handles vast sums every year. The Indian postman on the left with an umbrella hooked on his arm seems to be prepared for either rain or shine. On the right is a postman of Lapland delivering letters in his crudely built sailing boat. Postal deliveries are rare in this sparsely settled country.



London has its underground "tubes" in which the mail bags ride in cars operated automatically. Two employees are here seen unloading cars. Less rapid methods prevail in the Spreewald, a watery district of Germany where the postman poles his craft up to the front door. On the right is a tram-car in Sweden with a letter box attached to the front, from which a white-coated postman is just emptying the letters posted in it by travellers on the tram.



POTATOES FROM STACK TO SACK

Above, a potato clamp for storing the crop is being made. The tubers are piled into a neat triangular heap in a shallow pit sometimes lined with straw. After maturing in the clamp the potatoes are ready for transference to sacks, which are loaded, as shown on the right, by means of an implement which looks like a cross between a spade and a fork.

Photos B. W. Taitersall

the soil, and rivers carry them into the sea. There they are so diluted and mixed with other salts that separation is not feasible. Sometimes, however, the potassium salts emptied by streams into lakes have become so concentrated, owing to the drying up of the lakes, that the salts can be profitably recovered.

Lakes, evaporated in earlier geological ages, left beds of crystallized potassium salts. These deposits, sealed under layers of silt 1,000 feet thick and thus protected from rain, were later uplifted, and the silt hardened into rock. To find the potash, deep holes are bored with drills down through the rock. The first of the subterranean deposits was found in Germany.

Potassium nitrate (KNO_3), now used in increasing amounts as a plant food supplying both potash and nitrogen, is valuable also in the manufacture of gunpowder. The chloride (KCl) is employed in preparing other potassium salts, and for artificial fertilizers. Caustic potash, or potassium hydroxide (KOH), is used chiefly in making soft soap. Potassium chlorate (KClO_3), an effective source of oxygen, is an ingredient of fireworks, flashlight powder, safety matches, dyes, and explosives. The bromide (KBr) and the iodide (KI) are used in photography and medicine. Potassium cyanide (KCN) is a valuable agent for extracting gold from low-grade ores, and a source of hydrocyanic acid or of "prussic acid," a deadly poison used in fumigating. The carbonate of potassium (K_2CO_3) enters chiefly into the manufacture of

hard glass and soap. The metal is generally prepared by electrolysis of fused caustic potash.

Potato. When Cortes and Pizarro conquered Mexico and Peru for their gold and silver, they found the natives cultivating and eating tubers from which our ordinary potatoes are descended. They carried back some of these to Spain, and knowledge of the potato spread to Italy, Holland, and other countries. The doughty English sea-captain, John Hawkins (*q v*) brought the first specimen from South America to England in 1563, and some 20 years later Sir Walter Raleigh showed some to Queen Elizabeth, after the return of the expeditions he had sent to Virginia, now a State of the U S A.



The potato as developed by cultivation is one of the most prolific of food plants, producing more food per acre than any other crop. It also has a wide range of cultivation, maturing farther north and at higher altitudes than any other important food crop except barley. A very high proportion of the world crop is grown in Europe, where it meets the needs of the crowded continent as a food for man and stock.

The cultivation of the potato has played an important part in the history of Europe. In certain parts of Germany it helped to check the famines caused by the Thirty Years' War. By 1688 it had become the staple food of the Irish peasantry, and the failure of the potato crop in 1845 and the resulting famine set going the first wave of Irish emigration to the United States, besides indirectly giving the Irish people yet another grievance against the English.

But in many places the introduction of this new food encountered prejudice and misrepresentation, for it was ignorantly said to be the cause of leprosy and many kinds of fevers. A learned Frenchman named Antoine Parmentier did much to dispel such prejudice through a

series of books and pamphlets (1773-89), in which he urged its cultivation and use in France, and the French king, Louis XVI, wore the flowers of the plant in his buttonhole to popularize it.

The potato is about three fourths water, the remainder being starch, with small amounts of protein and fats. The proteins are in a layer next to the skin, and may all be wasted by deep paring. The potato is valued as a carbohydrate food, for the starch cells of the potato, broken by cooking, yield starch in an easily digested form. Potato starch (akin to wheat starch) and potato flour are also manufactured products. In Europe, especially in Germany, a variety of potato is used for making fuel alcohol.

The white or "Irish" potato (*Solanum tuberosum*) is a member of that large and interesting nightshade family (*Solanaceae*) which also gives us tobacco, poisons like helladonna, foods like the tomato, and garden flowers like the petunia. The poisonous principle found in the potato berries and leaves may develop in tubers exposed to the light, which usually turn green in this condition, you should not eat parts of potatoes which are green.

The fleshy tuber is an underground stem in which the plant has stored up nutriment. The small purplish or white, wheel shaped flower with a yellow centre sometimes develops into a soft green berry full of seed, but in the cultivated potato the flowers are picked off before ripening.

ANCIENT ART of the POTTER'S WHEEL

From the hand-wheel and log fire of the primitive potter to the electric furnaces and marvellous moulds of his modern successor is a long step, yet the art of pottery remains much the same in essentials

Pottery AND PORCELAIN The potter's art depends on the fact that clay, mixed with water, can be moulded into shape, and that by



baking the clay mixture becomes hard. All pottery has two things in common: the body or main bulk, made from the clay foundation, and the glassy, water-proof glaze that coats the body. There are many kinds of clays and glazes, and upon the fineness of the materials used depends the grade of pottery produced. Some clays are so fine that they

can be used without more than a preliminary washing, others must be washed and ground and bleached in various ways before they can be put into use. For very rough work, clays may be used more or less "raw." It is infinite care in the preparation of the clays that gives to China, Japan, and France their perfect results in china making.

The clay or "slip" may be shaped in many ways—by throwing on a potter's wheel, by turning lathes, by shaping it with the hand over moulds, by pressing it into plates or saucers or over flat ware, by casting in plaster-of-Paris moulds, or by packing the dry clay powder, only slightly moistened, into dies and then pressing it under terrific pressure.

The potter's wheel, the oldest of the potter's tools, is used for shaping vessels such as cups and vases. It is simply a round piece of board

set horizontally on top of a revolving spindle, the speed of which is controlled by the potter.

The potter, who is called the "thrower," throws a lump of clay on the wheel so that it sticks fast, revolving with the wheel. As the wheel spins he fashions the desired article with skilled hands. He works up from the base, shaping the walls. His fingers, bent in a peculiar manner, touch the top of the bowl, and it rises into a beautiful vase. Another touch and the top rolls over into a lip. If he is making a cup or mug, a handle is fashioned and fastened on with slip. When it is done, he draws a wire deftly between the board and the object and puts it away to dry.

Pieces of pottery so made are known as thrown ware, but except for the finest porcelains and for the work of individual potters, the potter's wheel has been replaced by speedier methods.

China Made by Casting

Fragile cups and bowls, and most of the exquisitely shaped figures and ornamental vases are cast in plaster of Paris moulds, which have been designed by sculptors. Into these moulds the liquid slip is poured. The water in the slip filters through the mould, leaving a thin layer of clay behind. When this layer is thick enough, all the remaining liquid slip is poured out, the clay lining soon becomes stiff, shrinking a little in the process, and the pieces of the mould are stripped off. If the outline is very irregular, the model is cut into several pieces, and from these pieces plaster moulds are made. Sometimes, for very elaborately designed objects, more than a hundred sets of moulds are necessary. "Egg-shell" china is made by casting.

Many pieces are fashioned on a "jigger," a revolving mould over which a sheet of clay is



A MASTERPIECE BY A SCULPTOR WHO TURNED POTTER

For centuries this Madonna and the Angels smiled down from the doorway of the Casa Tanti in Florence, Italy. It is a priceless work by Luca della Robbia, the famous Renaissance sculptor who learned how to make the exquisite "della Robbia ware." His nephew, Andrea della Robbia, carried on his work with somewhat less skill. This Madonna is now in the National Museum, Florence.

pressed and quickly shaped. It is then dried and planed smooth to an even thickness.

Large pieces of tableware are shaped by hand, pressed over or into moulds the exact shape required. Usually each piece is made in several sections. Plates and other flat ware are moulded.

After the article is shaped and dried it is placed with many others in boxes of fire-clay, called saggars, and arranged in a kiln. The entrance is bricked up and the fires lighted. Gradually the heat is increased until the required temperature, which may be 3,000 degrees Fahrenheit, is reached, there it is kept until the clay has "fused" to a hard consistency. Two or three days are required for the kiln to cool off, then the entrance is unbricked and the saggars taken out. In this condition the pottery is known as biscuit ware, and sometimes it is not glazed at all and marketed in this state. This is especially the case for sculptured groups and figures.

In another part of the factory the glaze has been made. Materials which make glass have been mixed together and haked into solid sheets, and these plates have been ground until they are pulverized. This flour-like mass is mixed with water to form the glaze "slip" or wash. Into this, skilled workmen dip the biscuit ware so that every part is evenly covered. The pottery then goes to the glaze kiln to be haked again, although at a lower temperature, until the glaze is fused, covering the pottery with its hard, glassy coating.

Some pottery, especially the hard stoneware, receives what is known as a salt glaze. When the kiln in which the pottery is being fired is at a certain heat, the saggars are opened and some common salt (sodium chloride) is thrown in. The heat vaporizes it, and as the oven cools the vapours condense on to articles in the form of a transparent glaze. Salt glazing is used largely in the heavy, grey-blue ware of cooking utensils and mugs.

Decorating is put on by hand or by transfer patterns, or by a combination of both. For flat ware, printed designs are commonly used, this system having been evolved in England during the 19th century. The patterns in colour are transferred to tissue paper from engraved plates, and this tissue paper is applied to the plate, saucer or platter and soaked off, leaving the design on the dish. Sometimes the decorations are put on before the glazing, when it is known as "underglaze," and sometimes over the glaze, and often there is a combination of both.

Colours Changed in the Furnace

The various colours undergo great change in firing. Gold paint is dull and brownish before it is fired, black is blue, and pink is brown. Also the different colours require different temperatures to set them, and sometimes a vase has to be baked eight or nine times in the special kilns used for "over-glaze" colours before the design is complete.

The term "ceramics" was originally applied to pottery-making and clay-working industries,

HOW CLAY IS TURNED INTO CUPS AND SAUCERS



1 For some fine wares the clay and other materials, after being carefully weighed out according to formula, are ground for hours in pebble mills like these. The cylinders contain water and flint pebbles which convert the ingredients into a thick creamy mass called 'slip'. 2 The slip goes to the operator of a jiggering machine which is the old potter's wheel spun by electric motor. On it the worker shapes plates, cups and bowls. 3 After the shaped or moulded pieces have been dried and baked once they are dipped in a glaze to give a hard, glossy surface. Expert glaze dippers slip them in and out of the bath so quickly that the work goes like magic. Yet the thickness of the glaze must be absolutely uniform or the piece will crack in the glaze kiln where it is baked to fuse the glaze. 4 For a more elaborate piece the slip is not shaped on the jigger but is poured into moulds which shape the piece one-fifth larger than it is wanted, to allow for firing later. Handles, spouts and knobs are moulded and affixed by hand to bowls and cups. 5 For each firing the pieces are put in earthenware pans called 'saggers', and (6) balanced calmly on the heads of workmen who carry them to the kiln where they are stacked to be fired at a high temperature.

TRIUMPHS OF THE POTTER'S ART IN THE ORIENT



1 Glazed and lustrous bowl from Rhages, Persia, 12th century
 2 Chinese plate, with flying duck, clouds, and lotus design, in brown, green, and blue glaze, Tang dynasty, 618-906 A.D.
 3 Persian jar, 13th century, of the Rhages type, glazed in turquoise, with fish and seaweed design in black
 4 Model of a watch tower, in green glazed pottery, placed in a tomb, Han dynasty, 206 B.C. to 220 A.D.
 5 Japanese censer, early 19th century, these of Satsuma pottery in crackled cream glaze, design of tortoise and jewels in green and red enamels
 6 An 18th-century tea caddy of "Chinese Lowestoft" ordered in China by employees of the East India Co.
 7 One of the Lions of Buddha, from the X'ang Hsi period
 8 Chinese wine jar, about 1500 A.D.
 The reader should note that the objects in this page of illustrations are not represented in their relative size. The Persian bowl, 1 as in the Metropolitan Museum of Art, New York City, and 2 3 4, 5, and 6 are from collections in the Art Institute of Chicago

FAMOUS STYLES IN THE 'WARES' OF MANY LANDS



1 An 18th century Chelsea porcelain figure of a hunter 2 A vase in Mexican majolica, 1680, in a fine rhythmic pattern of blue and white 3 The Empress Elizabeth of Russia, daughter of Peter the Great, in 18th-century Meissen ware 4 A plate of 16th-century Italian maiolica in Florentine design 5 A vase in the famous Jasperware of Josiah Wedgwood, great English potter, who followed the 18th-century taste for classical models

6 "Tulip ware" made by the Pennsylvania Germans in the early 19th century often had a design of tulips, much conventionalized 7 Bernard Palissy, French master of ceramics, loved to model on his platters water creatures dredged up from the Seine 8 Chinese influence is apparent in this 18th-century delft plaque The Tulip ware plate is in the Metropolitan Museum of Art New York City and 1 3 5, and 8 are in the Art Institute of Chicago

POTTERY & PORCELAIN

but now it is generally applied to all industries using earthy material and requiring the action of heat in the perfection of the product. The ceramic industries embrace the manufacture of all kinds of clay products, such as stoneware, china and porcelain, brick, tile, sewer-pipe, terra-cotta, Portland cement, enamelled metals and sanitary ware, all the many varieties of glass and glassware, etc.

The making of pottery is the oldest of the arts known to Man. It is not until the historic age, however, that there is evidence that the potter's wheel was used. It appears that it was developed more or less independently in all parts of both the Old and the New World. Primitive peoples are still ignorant of its use.

After the barbarian invasions the fine arts died in Rome and Greece. The ceramic work that was done in the Middle Ages was very crude, except that of the Moors in Spain.

In the re-birth of pottery, Italy led. Among her most beautiful wares was majolica (*maiolica*), a decorated enamelled pottery usually made of coarse paste covered with an enamel containing tin. Another choice variety of majolica, decorated in many colours and first made in Faenza, Italy, is known as *faience*, later this was highly developed in France.

The Dutch, too, played a part. They gained from China a knowledge of pottery which they combined with the knowledge of glazing they got from Italy. They learned how to make a blue colour by using oxide of cobalt, and began to turn out blue and white pottery known as Delft, from the town of that name.

Discovery of Palissy's Glazes

About the middle of the 16th century Bernard Palissy, a potter of Saintes, France, introduced new methods which made his name famous in the history of pottery-making. One day he saw a superb white enamelled cup—very possibly a piece of Chinese porcelain, then a wonder to Western eyes—and he determined to discover how it was made. Although he never found the secret, he discovered how to make beautifully coloured enamels by colouring the glazes before putting them over the baked clay, instead of using a white enamel and then painting it.

Working under the patronage of the king or the government, French potters led the Western world for several centuries, creating lovely *faience* in the 16th and 17th centuries, as well as artificial porcelain, known as "soft paste."

To speak of porcelain is to speak of China, for in that country the wonderful art of its manufacture was discovered and brought to such perfection that it is still the despair of modern craftsmen who seek to copy it. Even the Japanese did not make it before the 16th century.

The beautiful and elaborately decorated ware of China first found its way to the West when

the great Saladin sent 40 pieces to the Sultan of Damascus in 1171. From that day to this porcelain has been the pride and delight of kings and princes and men of wealth, and particularly perfect and ancient specimens have been sold at prodigious prices. (See China.)

The Three Porcelain Materials

The essence of the secret lies in the materials used: kaolin, a very fine clay, powdered felspar, called by the Chinese *petuntse* and by the English "Cornish stone", and quartz or sand. Both kaolin and petuntse are the natural products of weathered granite. Kaolin consists chiefly of alumina and silica, and cannot be melted. Felspar is a silicate of aluminium, combined with soda, potash, and lime or barium. It melts at high temperatures, and by holding the kaolin in suspension as it cools gives the porcelain its beautiful translucent texture.

The European "soft-paste" was made of clay suspended in an artificial glassy medium. Beautiful wares were made of artificial porcelain, but they lack the characteristic hardness, depth, variety and richness of true porcelain.

The making of true or hard-paste porcelain in Europe dates from 1709, when a German, named Boettger, discovered kaolin and felspar near Dresden and started the famous Meissen factory. Such importance was attached to this discovery that Boettger and his workmen were imprisoned in a fortress so that the secret would not leak out.

But the workmen escaped and earned this secret with them over Europe. Dozens of factories soon began making true porcelain, and their finest productions have brought prices that approach those paid for Chinese and Japanese wares. Dresden china, as that made at Meissen is called, and Sevres ware, made at Sevres, France, are the most highly esteemed varieties. Other famous factories were founded at Vienna, Berlin, Chantilly, and many other cities in Europe.

Famous English 'Wares' and Potters

In England, where porcelain was first made about 1745, "bone porcelain" was invented about the middle of the 18th century. This contains bone-ash, which renders it more easily fusible than true porcelain.

The famous English potteries at Bow, Bristol Chelsea, Derby, Lowestoft, Worcester and elsewhere were thus able to produce a pure white, hard, tough ware much more cheaply than the factories on the continent, although they continued making true porcelain as well.

Josiah Wedgwood (1730-95) was England's greatest potter. His classic vases, ornamented by the sculptor Flaxman, are among the most beautiful pieces of pottery ever produced. Besides these beautiful pieces of art, he made many other more useful types of ware.

Most important in England has been the development of earthenware, which imitates and



Plymouth Rock



Wyandotte



Orpington



Rhode Island Red

rivals true porcelain, it is a fine clay containing quartz and felspar, but not normally kaolin. It has long held the lead for domestic purposes. Of recent years, both in England and on the Continent, there has been a tremendous revival in pottery making as an art, and there are many fine potters now in Britain. Some take their inspiration from Oriental designs, others work with new ideas and even use decorations derived from Surrealist art, another group specializes in colour—as, for instance, in the effects obtained by using different types of wood ash in their glaze, many have brought beauty to big, heavy domestic stoneware.

Poultry. At what period the chicken was first domesticated and bred by Man is not known. Scientists believe that the wild fowls from which our breeds originated were natives of south-western Asia, and that one of the species which contributed most largely to its ancestry is represented today by the red jungle fowl of India. This wild fowl weighs less than two pounds, on the other hand, one of our table birds ready for the market sometimes turns the scale at as much as sixteen or seventeen pounds.



Cocker



Langshan



Brahma

Poultry include chickens, ducks, geese, guinea fowls, and turkeys, but the hen's is the only egg of commercial importance. Practically all the eggs of other domestic birds are used for breeding purposes.

The importance of poultry as a factor in national health and wealth is not appreciated by many people, chiefly, perhaps, because chickens and eggs are often by-products of the ordinary farm. Except on large poultry farms, they are generally raised by the farmer's wife, who may or may not be able to give them the same degree of attention that the farmer gives to the main crops.

The more highly organized the egg and poultry market is, the better are the results. In Denmark egg producers are organized into a co-operative association, which stamps every egg with an identification mark, and holds each producer responsible for the quality.

In the production of eggs, while the wild fowl lays only one small setting of eggs a year, a flock of good layers average 120 eggs in a year, and prize-winners reach a mark well over 300.

If possible, poultry should be kept on high and well drained land.



Andalusian



Ancona



Minorca



Leghorn

SOME OF THE MOST IMPORTANT BREEDS OF POULTRY

The upper row includes the breeds best for general purposes, they are good layers and attain medium size. The lower row includes some of the best layers, while the middle three are heavy meat breeds.



JUST OUT OF THE EGGS

These little chicks have only just been hatched. With the broken fragments of their first homes in the foreground, the downy brood are being transferred from the nest to the more hygienic coop.

Reasonable protection from cold winds is desirable, and also plenty of sun, especially in the autumn and winter months.

Some breeds do better on certain soils than others, and as a rough guide it may be remembered that it is preferable to have yellow-legged birds on heavy ground, and white or blue-legged birds on light ground.

Improvement in weight of meat and number of eggs produced in any flock may be brought about by selecting only the best for breeding purposes, by keeping them in a clean, well-aired poultry house, and by giving plenty of clean water and good food, selected in proper variety for a balanced ration (See illustration page 1689).

The trap-nest system, which enables the poultry farmer to keep an accurate record of the eggs laid by each hen, is a great aid in improving a flock for egg production. There are other methods, too, by which the poor layers can be eliminated and the eggs for setting selected from only those layers with the highest records.

The hen seldom exercises the art of the wild fowl in making her own nest for her eggs, but occasionally one desiring to sit will steal away to a nest hidden in a spot of her own choosing, and lay her one egg a day until there are as many in the nest as her feathers will cover. She will then patiently keep them warm with

the heat of her body for twenty to twenty-one days and produce her own brood of downy chicks.

A mother hen exhibits a highly-developed instinct in caring for her family. She teaches them by patient example how to drink, how and what to eat, and calls them with special fervour to enjoy a worm or other tempting morsel. If danger threatens, her prompt warning makes them hide under the nearest cover until all possibility of trouble is over.

When their old enemy the hawk sails menacingly overhead, his fleeting shadow on the ground is spied by some watchful chicken, and a warning is given that sends even the grown-up members of the flock hurrying to cover. This instinctive fear was developed ages ago by the danger of wild life, when hawks, foxes, weasels and many other animals showed a fondness for fresh chicken, and after centuries in the domestic pen this instinct is still active.

The time of sitting and of caring for a brood is just so much time lost from laying, since the hen does not begin laying again until the young chickens are well able to care for themselves. For this reason, in a flock of any size, sitting is discouraged by the poultryman. These hens that show a desire to sit by staying on the nest, and clucking while off the nest, are cooped up to "break" them from sitting. In place of the sitting hens, with their tiny broods, we have the oil or electric incubators in which eggs by the hundreds are hatched.

Artificial incubation is not a new practice, for the ancient Egyptians, we know, placed eggs



FOILING THE FOX ON A POULTRY FARM

Poultry breeders have to be on their guard against the predatory fox, or otherwise they would lose a large number of their stock. Here, on a duck farm in Essex, we see an ingenious method of foiling Reynard. The compound is entirely surrounded by a fence of wire netting, the top of which is fixed so that it slopes outwards.

in large brick ovens which held an even heat, hatching them in large numbers. The incubator is planned to imitate the natural conditions for hatching. A warm, even temperature is provided by means of lamps automatically regulated, with a supply of fresh and slightly moist air. Since a hen carefully turns the eggs in her nest, so likewise the eggs in the incubator are turned over frequently during the period from the third to the eighth day.

At the end of one week the eggs are tested, and those eggs which are not going to hatch are removed. The eggs are held before a light, and the infertile eggs appear clear and translucent. At the end of 14 days a second test is made to weed out those in which the embryo has died.

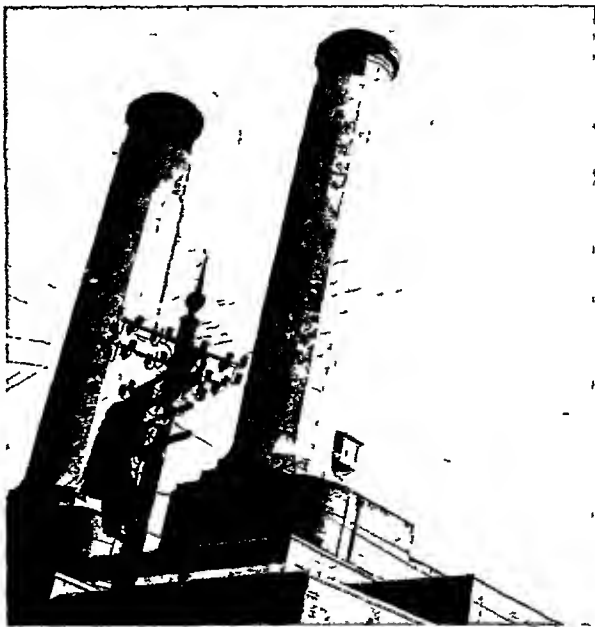
Finally, at the end of the third week, comes the time of greatest interest, when first one and then many of the tiny bills hammer on prison walls and the downy yellow chicks make their way out of their shell. From the incubator they are put into a warm "brooder," where they live the life of pampered orphans who are not allowed to venture out in the wet grass to hunt for food, but are fed and tended till they can look after themselves.

A feature of poultry raising in some countries is the practice of pasturing the flocks. A girl or boy is hired to take all the poultry of a village out to forage for themselves, and the goose girl, or goose herd, watches the birds while they feed. They also drive them along the road to market. In Italy, for example, it is a common sight to see large flocks of geese being driven down from the Alps to the nearest market.

There are about a hundred varieties of the domestic chicken (*Gallus domesticus*), divided into two principal classes—those which are best for laying and those valued as table-birds. Included among the former are the White Leg horns, Ancona, Andalusian, Light Sussex, Buff Plymouth Rocks, and Minorcas. The best meat birds are a cross between Indian Game and the Dorking, Buff Rock, White Orpington and Light Sussex breeds.

Besides these breeds there are the ornamental varieties and others raised chiefly as curiosities, such as the Silkies and the Malayan fowls. The bantam breeds are interesting members of the poultry family, although there is no practical advantage in their dwarfed size and small eggs.

Ducks are easy to keep, and thrive quite well without a pond. Geese and guinea-fowl, too, present few difficulties, though the latter have a habit of hiding their nests. Turkeys, on the other hand, are rather delicate birds. (See also Duck, Goose, Guinea-fowl, Turkey)



TWIN SYMBOLS OF POWER

The great smoke-stacks of the Fulham Power Station. London, make a striking picture. Opened in September, 1935, this huge municipal generating station can develop a total capacity of 310,000 kilowatts. It is a "base load" station, from which the Central Electricity Board distributes current to wholesalers throughout Great Britain.

Power. Thousands of men worked for generations to build the great pyramids of Egypt. Today, with the help of modern machinery, a few hundred men could complete them in a few months. The difference in time consumed lies in the application of power.

Just what is power? The words *work*, *energy*, and *power* are used loosely in common speech, but to the physicist or engineer each has a distinct meaning. Work means the overcoming

of resistance, energy is the capacity for doing work, but power implies the capacity for doing work at a given rate. In building a pyramid, for example, the amount of work done and the energy used in doing it would be much the same whether the task was performed by human hands over many decades or by stone-cutting machines and steam hoists in a single season. But the power applied in the latter case would be many times greater than in the former because the work is done faster. (See Energy, Physics)

We often boast that our material civilization has advanced more rapidly in the last 200 years than it did in the preceding 2,000. For this progress we must be grateful to power, which we have learned to obtain chiefly from coal and water for use in driving machines.

Man's first source of power was, of course, his own muscles. But hundreds of centuries ago he learned how to supplement his efforts with those of domesticated animals. Most useful of all, because of its strength, speed, and ease of handling, was the horse. For ages the amount of work a man could do depended in large part on the power of the horses available to him. And ever since then power has been measured in terms of the work a horse can do. One *horse-power* is the power required to raise 33,000 pounds one foot in one minute. It is about ten times the power which the average man can exert consistently throughout a day's work.

Perhaps the first application of natural sources of power came when men hoisted sails over their boats to harness the wind. Thousands of years elapsed before the same principle, slightly modified, was applied to driving windmills. The Egyptians and Greeks used the energy of flowing streams to drive crude water-wheels.

Pioneers of the Modern Power Age.

Newton, with his famous laws of mechanics, and the long line of great scientists who followed him, were the prophets who pointed the way to our modern era of power. They showed what principles had to be followed to put energy to work through machines. Inventors followed in the footsteps of the scientists. The steam-engine transformed our civilization simply because coal was able to turn the water in its boiler into steam, and the engine turned the expansion of the steam into power. The water turbine harnessed the force of falling water. Both steam and water were set to driving electric generators which distributed power through cables to countless humming motors. The energy locked up in petroleum was turned into power by the internal combustion engine, and within a single generation millions of motor-cars were speeding along our roads and streets. Because this particular kind of engine developed more power for its weight than any previously invented, it made flying possible. (See Electric Lighting, Fuels,

Internal Combustion Engine, Steam engine, Water-power)

You will often hear engineers talk about the "efficiency" of a machine. In this technical sense, the word generally means the amount of useful power a machine develops in proportion to the energy that is fed into it. For the various terms used in measuring energy, work, and power see the article on Physics. The common measure of electrical power is the *watt*. One horse-power equals 746 watts. The *Lilovatt* is one thousand watts and equals 1.34 horse-power.

Powers and Roots. The calculation of powers and roots has largely been done away with by the use of special tables and logarithms. But so that you will be able to understand how these tables are used and make a simple development of the theory of powers and roots is given here.

Multiplying a number by itself two, three or four times raises it to its 2nd, 3rd, or 4th power. Thus, 4 or (2×2) , 8 or $(2 \times 2 \times 2)$, 16 or $(2 \times 2 \times 2 \times 2)$ are the 2nd, 3rd, and 4th powers of 2. The number itself is its first power. Powers are indicated by indices, thus, 2^2 , 2^3 , 2^4 , 2^5 . In algebra powers are shown in the same way m^2 , m^3 , $(a+b)^2$ $(x-y)^3$. The 2nd power is the "squares," the 3rd power is the "cube." Any number with the index 0 equals 1, a negative index means the number is to be used as a denominator, thus $3^{-2} = \frac{1}{3^2}$.

If the number we wish to square (raise to the 2nd power) consists of two digits or terms, as 25 , 34 , 86 , $a+b$, or $b-c$, the process of multiplying the number by itself reveals a certain law which helps with the reverse process of working back from the square to the first power (finding the *square root*). Compare the steps in the same multiplication done in two ways

$$\begin{array}{r} 25 \\ 25 \\ \hline 125 \\ 50 \\ \hline 625 \end{array} \quad \begin{array}{r} 20 + 5 \\ 20 + 5 \\ \hline 400 + 100 \\ 100 + 25 \\ \hline 400 + 200 + 25 = 625 \end{array}$$

We see from this that the squares of 25 or 625 is made up of the square of the first term $(20 \times 20 = 400)$ + twice the product of the first term by the second $(2 \times 20 \times 5 = 200)$ + the square of the second term $(5 \times 5 = 25)$. Compare with the following algebraic operations

$$(a+b)^2 = a^2 + 2ab + b^2 \quad \text{or} \quad a^2 + ab \quad (b-c)^2 = b^2 - 2bc + c^2$$

$$\frac{ab+b^2}{a^2+2ab+b^2} \quad \frac{b^2-c^2}{b^2-2bc+c^2}$$

Now, if we understand this law, the operation of finding the square root will be simple. By looking at these squares 49, 64, 81, 144, we perceive that their square roots are, respectively, 7, 8, 9, 12. But we can seldom tell what the

square root is by inspection We must work it out by steps

Find the Square Root of 2304

To find the square root of a number, such as 2304 0, mark off the numbers in pairs from the decimal point thus 23 04 0 Now find the largest number (in this case 4) whose square (16) is contained in the left-hand pair Subtract the 16 from the left-hand pair, leaving 704

$$\begin{array}{r} 23\ 04\ 0\ 1 \\ 10 \\ \hline 704 \end{array}$$

Now we must multiply the figure in the root (1) by 20 (giving us 20) and divide the remainder by this In this case 8 will go into 704 5 but not quite 9 times So we may take 8 as a 'trial quotient' for the next stage Adding it to the figure 20 (giving us 28) we know many times it will go into 704 The answer is, 5 times exactly

$$\begin{array}{r} 423\ 01\ 0\ 4 \\ 10 \\ \hline 85\ 704\ 16 \\ \hline 704 \end{array}$$

So the square root of 2304 is 48 Sometimes we may find that the trial quotient gives too high a result so then the next lower figure must be tried This would mean in this case dividing 87 into 704

These steps employ the same process as is used in solving the problem algebraically Thus we can say that $2304 = (a+b)^2$ and make $a=10$ and $b=8$ Then $a^2 + 2ab + b^2 = 1000 + 040 + 64$, or 2304 The position of the 1 in the root makes it equivalent to 10 so by subtracting 1000 (=a²) The remainder in algebraic terms is $2ab + b^2$ Dividing 24 (that is $2 \times 10 + 16$) into it gives us $b (=8)$ as a trial quotient and multiplying $80 - 8$ by 8 gives us the arithmetic equivalent of $2ab + b^2$

Similarly, we may find a law about the make up of a cube which will help us to understand the process of finding the cube root Let us cube 12

12	Writing this as	10 + 2
12	10 + 2 and squaring	10 + 2
24		100 + 20
144		20 + 4
12	multiplying again	100 + 40 + 4
288	to get the cube	10 + 2
144		1000 + 400 + 40
1728		200 + 80 + 8
		1000 + 600 + 120 + 8 = 1728

In algebraic form our number amounts to $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$, in which $a=10$ and $b=2$ Our solution follows the algebraic one, as the following example, using a different number, will show

Find the Cube Root of 15,625

- 1 Mark off the given number into periods of three numbers each 15 625
- 2 Determine the largest number whose cube goes into the first period write it as first figure of the root, and subtract its cube This subtracts a 15 625 (2 from number Subtracting in the 1,000 column allows for the root whose being a multiple of 10 7625

- 3 Multiply the root number by 10, square the result, and multiply by 3 (this gives 3a²) Use as a trial divisor, obtaining trial quotient of 5 These steps 20 x 20 x 3 = 1200 15 025/125 are not shown 20 x 5 x 3 = 300 8 7625 Multiply the first term of the root 5 x 5 25 1325 x 5 = 6625 (2) by 10 then by the trial quotient 5 then by 3 (this equals 3ab) Add this to the trial divisor and add the square of the second term, obtaining the complete divisor (=3a² - 3ab - b²) Multiply by the trial quotient obtaining 7025 (=3a² b - 3ab - b²) This subtracted from the dividend leaves no remainder, so the desired root is 25



'GOLDEN CITY' OF PRAGUE

The crowning glory of Prague is the Cathedral of St. Vitus seen in the background, rising from the Hradcany fortress The Vitava, also known as the Moldau is here spanned by the Charles Bridge, built in the fourteenth century

© Colorbook Travel Bureau

Although it is necessary that you should know how to calculate the square root or cube root of any number, it need not always be necessary for you to do it yourself Elaborate tables, giving you the result at a glance, have been drawn up so as to save you many hours of prolonged calculation

Many calculations can be simplified by using a form of powers called logarithms in which every number is considered a power of 10 They are valuable because with them addition and subtraction can be substituted for multiplication and division, while multiplication gives powers and division gives roots (See Logarithms)

Prague, (Pron prahg) Chief city of Bohemia, Germany, and former capital of Czechoslovakia From the Vysehrad ('White hill'), once the centre of Prague, and now a melancholy waste of grass, winding roads, and modern fortifications, one looks down to the north upon a city of pointed spires, green domes, and red-gabled

PRAGUE

roofs Prague (or *Praha*), the former capital of the Republic of Czechoslovakia, is set like a gem among green fields and tree-covered hill-sides. Through these the Moldau or Vltava (a tributary of the Elbe) wanders, broad and swift, cutting Prague in two.

The older parts of the town give one a strange sensation of being still in the Middle Ages. On the left bank of the river is the ancient, frowning citadel of the Hradčany, now the seat of government. The dominating feature is the Cathedral of St. Vitus. This was founded in the year 925 by St. Vaclav, the patron saint of Bohemia.

PREHISTORIC

and the "Good King Wenceslas" of our Christmas carol.

But there is another, modern Prague, with tall characterless houses and fashionable shops. Great establishments for the making of railway rolling-stock are situated here, sugar refineries, breweries, and chemical works, for Prague was both the rail- and river-trade focus of all Czechoslovakia, and the nation's trade in glass, porcelains, textiles, and machinery passes through this busy town. The ancient university was founded in 1348.

The population of Prague is 962,000—about double what it was before the War of 1914-18.

MONSTERS of a MILLION years AGO.

From their skeletons, discovered all over the world, scientists have been able to reconstruct the now extinct monsters of prehistoric times. These are perhaps the strangest creatures ever seen on earth, as our pictures show.

Prehistoric Animals. It was hot and stifling in the swamp. Great ferns as big as trees held their tracery aloft in the still air, and over the mud of the bank great mosses clambered and a thick tangle of undergrowth steamed. In the warm water aquatic plants grew in masses.

There was no man alive to breathe the stifling air, for Man had not yet been born. For this was in the Mesozoic geological age, the "age of reptiles," before any mammals had been evolved.

Half in the shallow water and half out a great bulk lay, like a slumbering mountain. Suddenly it began to move, and slowly and clumsily it clambered to its feet and lumbered up the bank.

It was a creature 65 feet long and weighing nearly 40 tons, with a tail over 20 feet long and a ridiculous little head set on a long heavy neck. It moved slowly away from the bank, pausing now and again to feed on the tops of fern trees.

But suddenly its small stupid eyes showed signs of alarm. It turned and started at a clumsy run for the shelter of the water. Too late! For another creature had sprung upon it. It was smaller than its prey, being only 34 feet long, but it was much more agile. It leaped and ran on, two great hind legs, and its three-toed feet were armed with strong claws. Terrible teeth were in its great head, and a blow from its powerful tail was a thing to dread. Only its front legs, like tiny arms, were built on a smaller scale.

With a snort of rage it leaped upon the terrified giant, and, seizing the great neck between its teeth, crunched through the spinal column. The giant crumpled, shook convulsively, and was dead. Then the hunter settled down to enjoy his feast.

Suddenly the earth quaked and trembled, and the spot where the hunter and his victim lay sank and was covered by an avalanche of mud. Ages passed. The swamp, pressed as it was beneath other layers of soil until it had become hard



EGGS OF PREHISTORIC REPTILES

An American expedition to Mongolia in 1923 made the first discovery of dinosaur eggs, and in 1925 an habitual nesting place of dinosaurs was discovered at Shabarakh Uusu. The eggs, like those seen above, were laid in circles, with the ends pointing inwards, and each egg measured nearly nine inches in length.

Photo: Natural History Museum

rock, was heaved up into a high plateau Man appeared and grew to civilization

And then one day the petrified skeletons of the two monsters were found, the tooth marks of the hunter still in the spine of the victim and men dug them out and marvelled at them For this is no fairy story Today their skeletons are in the Museum of Natural History in New York City, chipped carefully out of the rock, hone by bone, and mounted just as they may have been when the hunter held his feast

These two creatures belonged to the order *Dinosauria*, the largest land animals that have ever lived The giant was called *Brontosaurus* and the hunter *Allosaurus*

They were reptiles, related to the crocodile, and, strange to say, to birds

These huge beasts were, like modern reptiles, cold-blooded and, like them, too, they laid eggs They were extremely stupid, and even *Allosaur* could hardly survive today, when animals are quicker and more intelligent But in the "age of reptiles" they were lords of the earth, and they ranged over Europe, North and South America, Africa, Australia, and the island of Madagascar (See illus p 1278 and p 1707)

There were many different species There was *Tyrannosaurus*, much like *Allosaurus*, but bigger and, if possible, more terrible, and *Megalosaurus*, a near relative These were meat eaters

Among vegetarians were *Diplodocus*, who might have been a brother of *Brontosaurus*, except that he was even bigger, being 87 feet long, *Iguanodon*, whose tail was flat, so that it could be used for swimming *Stegosaurus*, with great plates that stuck up from his spine and heavy spikes on the end of his tail, *Triceratops*, with an enormous head, which, with its neck-frill of bone, was 8 feet long and had three horns on its face The smallest of them was about the size of a cat, and *Diplodocus* was the largest

In that age the Pterodactyls were lords of the air They were reptiles, too The smallest,



PETRIFIED SKELETONS OF PREHISTORIC BEASTS

In the upper photograph we see the skeleton of an animal long since extinct—the Saurorophus or crested lizard Its remains were excavated in Alberta Canada The lower photograph shows the remains of a Corythosaurus or helmet lizard another reptile of the prehistoric ages, being patiently freed from the surrounding Cretaceous rock

Courtesy of American Museum of Natural History

which were also the earliest, had a body not much larger than a sparrow's From this the Pterodactyls ranged in size to *Pteranodon*, the largest creature that has ever flown The earlier species had teeth, but these great flying lizards had a very long dagger-like beak instead

Pteranodon had a spread of wing of over 20 feet, a small stumpy body, which probably did not weigh more than 25 or 30 lb, an enormously long skull, from the back of which protruded a long bony crest—the skull with the crest was nearly 4 feet long—and huge bat-like wings composed of a membrane or skin, which stretched from his legs to his body and was supported by his little finger bone, which was 2 feet long He had no tail, and in flying he apparently steered with the crest of his head and his legs (See illustration in p 508)

On the wing, the Pterodactyls must have been very agile, but on land *Pteranodon* must have been unable to move about, for he could not fold his wings conveniently away, and probably hung hat-like from the cliff by his fingers and toes It is supposed that they laid eggs Their food was fish and perhaps small flying things They had no feathers, and were probably scaly like the other reptiles

The sea also sheltered strange creatures in this Mesozoic age *Ichthyosaurus* is perhaps the



EXTINCT REPTILE THAT SWAM IN THE SEA

The most interesting fact about the Ichthyosaurus, or fish lizard, one of the fish-finned order, is that it brought forth its young alive instead of laying eggs. Thus we know from a specimen found near Wurttemberg with six embryos within the cavity of the ribs. The commonest English species of the Ichthyosaurus were about three or four yards long.

American Museum of Natural History New York

best-known genus, and with him lived *Plesiosaurus*—both were ferocious carnivores, the most terrible inhabitants the sea has ever had. Though they were really reptiles, the Ichthyosaurs looked not unlike whales, with their round and tapering bodies and their large heads. They had a tail with two points, the spine extending into the lower point. When full-grown they were sometimes 40 feet long. At the end of the Mesozoic age great upheavals of land and the colder climate caused the Dinosaurs to die out.

The remains of countless animals which existed both before and after these monster reptiles in prehistoric times have been dug out of the earth. Among the most interesting fossil discoveries is that of the primitive bird called *Archaeopteryx*, which is clearly a connecting link with the reptiles. About the size of a crow, it had no beak, but its long jaws were armed with teeth. Unlike all living birds, it had three sharp-clawed fingers on each wing and a long bony feathered tail. (See illustration p. 509)

The study of fossils, which is known as *palaeontology*, has given us the material on which we can base the history of life on the world through uncountable ages, and the remains of prehistoric animals, dug up all over the world, show us also how different the climate was in previous ages. (See also articles on Fossils, Geology, etc.)

Preposition.

The meaning of nouns and verbs is rendered clearer and more precise by the use not only of adjectives and adverbs but also of certain groups of words performing the same service. When we say "a girl with yellow hair," it is evident that the group of words "with yellow hair" is equivalent to the adjective "yellow-haired." In the sentence "The foe fled with haste," the group of words

"with haste" clearly modifies the meaning of the verb "fled" and is equivalent to the adverb "hastily." We call such groups of words *prepositional phrases*.

If you examine a number of such phrases you will find that they all consist of two principal elements: a substantive and an introductory word, usually a short one like *in*, *for*, *by*, *with*, *against*, etc. This introductory word is called a *preposition*, from the Latin *praeponitus*, meaning "placed before," because it is usually placed before the substantive it introduces, or, as we say, *governs it*. The duty of the preposition is to show the relation between the word it governs and the word the phrase modifies. Thus, in the sentence, "It will rain before tomorrow," the preposition *before* shows a relation of time between the preceding verb *will rain* and the following noun *tomorrow*.

Though there are comparatively few prepositions, they express a great variety of relations, such as time, place, manner, means,

PRE-RAPHAELITES

agency, excuse, accompaniment, destination, opposition source etc. The same preposition may express several of these relations in different uses, as *with* a hammer (*means*) *with* speed (*manner*), *with* me (*accompaniment*)

Pre-Raphaelites. This is the name given to a small body of poets and artists who in the second half of the 19th century broke away from the conventional insincere attitude that marked most of the art of the day, and sought inspiration in the simple, genuine, religious art preceding Raphael. Both in art and literature they strove for a quaint simplicity, strong, natural colours, and an odd realistic way of treating old medieval themes and scenes.

The movement was started in 1848 under the title of "The Pre-Raphaelite Brotherhood," by three young men, John Everett Millais (1829-1896), Holman Hunt (1827-1910) and Dante Gabriel Rossetti (1828-1892), and dedicated to a rebellion against the artificialities of the contemporary academic art. Let us get back to life again, was their motto. "Let us have something to say, let us shirk no detail, let us be sincere." Their aim was to attain the "directness, honesty, and inspiration which they discerned in the painters before Raphael." Their scrupulous fidelity to detail is illustrated by the story that Hunt went to the Holy Land to obtain local colour for his picture "The Shadow of the Cross," in which Jesus is shown at work in his home as a carpenter. When the painting was completed, a friend in England suggested that the shavings on the floor were from the wrong kind of tree. Thereupon, Hunt went to Palestine again to make certain that he had represented the sort of cedar wood on which Jesus would have worked.

At first these young men met with tremendous opposition, but gradually, through their sincerity, their undoubted technical skill, and their enthusiastic championship by Ruskin and others, they were appreciated as fully as they could have wished. Their greatest triumph was in 1896, when Millais was elected President of the Royal Academy.

Besides the three original members the "Brotherhood" included other painters, and also William Morris, through whom its ideals spread to work other than painting.

Men such as Burne-Jones and Ford Madox Brown, though not members, showed a good deal of the same minifnence, while, among illustrators, Walter Crane is in many ways a Pre-

PRETENDER

Raphaelite. Yet great though their influence was, and important as was the work they did and inspired—especially in crafts and in interior decoration, working here through Morris—the Pre-Raphaelites defeated their own ends to a great extent, for they themselves tended to become decadent, and in many ways they hastened the end of the whole Victorian period in art. So it is that now their reputation is very low, and pictures by them which fetched thousands of pounds soon after they were painted now sell for a hundredth of those prices.

Pretender. Two princes especially of the evil house of Stuart have been styled "Pretender" in English and Scottish history.

James Stuart, the "Old Pretender" (1688-1766), the son of James II and Mary of Modena, was born on June 10, 1688. The opponents of King James believed that the babe was not really the son of the king and queen, but that he was smuggled into the Royal apartments in a warming-pan. Resentment at such a (supposed) fraud was one of the causes which led them, with the aid of William III of Orange, to drive James II from the throne (See James, Kings of England).

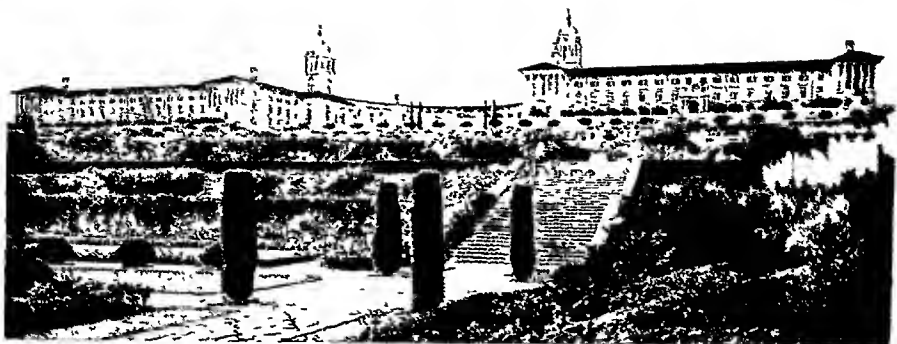
When James II died at the court of St Germain, in France, in 1701, a French herald



REALISM IN A PRE-RAPHAELITE PAINTING

Although not actually a member of the Pre-Raphaelite Brotherhood, Ford Madox Brown was a follower of their artistic style, as is visible in this realistic study of emigrants leaving home, "The Last of England." Notice the intricate detail in which every object is painted whether in the foreground or the background of the scene.

Birmingham Art Gallery photo Topical



IMPOSING UNION BUILDINGS ON PRETORIA'S HEIGHTS

The Union Buildings at Pretoria, seen above, overlook the city from the slopes of Manteje's Kop, and most of the materials used in their construction came from South Africa. The buildings were designed by the well-known architect, Sir Herbert Baker who was responsible for the plans of many handsome buildings in the Union, including Groote Schuur, the residence of Cecil Rhodes, the Rhodes memorial on Table Mountain, and cathedrals at Cape Town, Pretoria, and Salisbury, Rhodesia.

Courtesy of South African Railways

proclaimed the 13-year-old boy in Latin, French, and English, "James III, King of England and Scotland." Although the boy was received at the French court with all the honours which his father had received before him, and in England and Scotland a few nobles remained faithful to him, his life was one of constant expectation and disappointment. His invasion of Scotland in 1715, with French aid, failed. He died at Rome, January 2, 1766.

His son Charles Edward, the "Young Pretender" (1720-1788), was a more dashing and attractive character than his solemn father. His invasion of Scotland in 1745 aroused great enthusiasm among the Highlanders. Other "Jacobites" (as the Stuart adherents were called from the Latin *Jacobus*, "James") joined him, and he even reached Derby, 130 miles from London. But there his forces had to turn back and were soon scattered. The Duke of Cumberland followed the Pretender's Highlanders into Scotland, and on April 16, 1746 inflicted a terrible defeat upon them at the battle of Culloden Moor, about five miles from Inverness. (See illustration on page 2304)

Prince Charlie's Escape

Prince Charlie's own escape presents one of the most thrilling stories in history. When capture seemed inevitable he was rescued by a brave Scottish girl, Flora Macdonald (qv), who took him with her, in the disguise of a woman, past the line of vigilant sentinels. A large reward was placed on his head, and hundreds of persons were in the secret of his whereabouts, but none betrayed him. After five months wandering about western Scotland, he boarded a French vessel and escaped to the Continent.

This was the last real attempt to restore the Stuart line to the English and Scottish thrones, from which it had been deposed in 1688. (See also the article on Jacobites.)

Pretoria, South Africa. A thousand miles inland from Cape Town, the legislative capital of South Africa, is the seat of Government for the Union, Pretoria. This city, which was founded on the banks of the Tugela river in 1855 and named after Andries Pretorius (1799-1853), the Boer patriot who captured the early settlers in their wars with the Zulus, is today one of the most modern cities in the British Empire.

Classical Buildings in a Modern Setting

The Union Buildings, which overlook the low-lying city from the slopes of Manteje's Kop, were designed by Sir Herbert Baker and were built of South African materials. With their pavilions, loggias, colonnades, porticos, and other classical features they may be said to rival in grandeur of conception and execution some of the buildings of the Roman Forum or the Athenian Acropolis. Here are the quarters of the Premier of the South African Union and of the departmental ministers and their staffs.

Founded, as stated above, by Pretorius, the city became the seat of the Transvaal government in 1860. The discovery of gold and diamonds—the Rand is some twenty miles to the south—gave it a fresh importance. During the Boer War it was occupied by the British in 1900, but ten years afterwards it became the capital of the Union of South Africa.

There is a magnificent new City Hall, a University (created in 1930), the cathedral of St. Alban, a fine zoo, and numerous excellent

libraries and museums In the district are big steel works and an arms factory There are spacious suburbs at Arcadia, Sunnyside, Pretoria North, etc The European population of the city is given as 128 600

Priestley, JOHN BOYNTON (born 1894) Seldom does it happen that a dramatist has three of his plays running in London at the same time, yet it happened to J B Priestley, the son of a Yorkshire schoolmaster

He did not start his career as a playwright, but as an essayist, like the famous "Ella" Then he turned his attention to writing novels, but the first ones, "Adam in Moonshine" and "Bemighted," were not as well accepted as his rollicking story of "The Good Companions," though "Bemighted" was later made into a film as "The Old Dark House" "The Good Companions," told somewhat in the manner of Charles Dickens, was such a success that it was soon made first into a play and then into a film Other books—"Angel Pavement," "Faraway," and "They Walked in the City"—established his success as a novelist

Priestley graduated to the stage through the adaptation of

"The Good Companions" into a play In this he had the help of another dramatist, Edward Knoblock, but afterwards Priestley stood on his own feet and wrote a number of plays which were as popular as his novels

"Dangerous Corner" was the first one, and others were "Laburnum Grove," "Eden End," "Roundabout," and "Cornelius"

A lover of experiment, in his plays "I Have Been Here Before" and "Time and the Conways" Priestley dealt with some strange theories of time, first propounded by J W Dunne in a book called "An Experiment with Time" Even those who did not believe in the ideas were forced to admit that the plays were good drama and most original

Priestley, JOSEPH (1733-1804) A Non-conformist preacher with revolutionary tendencies so notorious that an angry mob burned his chapel and pillaged his home was at the same time one of the finest chemists that

England has known This man, Joseph Priestley, was born at Fieldhead, Yorkshire, on March 13, 1733 From 1752 to 1761 he held various posts as a minister, and also opened a school Three years later he attended chemistry lectures by Dr M Turner, and his studies in electricity gained him his F R S in 1766

Priestley invented a "pneumatic trough" enabling him to collect and examine gases, and by using mercury instead of water in his trough he could prepare samples of hydrogen chloride and ammonia for the first time By accident he prepared sulphur dioxide and silicon fluoride, and also decomposed ammonia and synthesized its chloride Independently of Scheele, but a year later, he prepared oxygen and described its properties This latter piece of research gave Lavoisier the clue to his theory of combustion,

which Priestley himself opposed strongly (See Oxygen)

In 1794 Priestley emigrated to America, settling at Northumberland, Pennsylvania, where he remained until his death, on February 6, 1804

Primrose. Perhaps no spring flower is so well-known as the primrose (*Primula vulgaris*), and few are so popular With its soft, yellow, rounded blossoms and hairy, crinkled leaves, it carpets the woods and lines the country roads, and is as welcome for its beauty as for its scent The primrose is often associated with Lord Beaconsfield, for it

was supposed to be his favourite flower, the day of his death, April 19, is known as Primrose Day At his death a wreath of its blossoms was sent by Queen Victoria to be placed upon his coffin and the primrose has since become the emblem of the Conservative party, and the Primrose League is one of the party organizations

The cultivated primroses range from bright yellow to the deepest purple The best known are the garden primulas, some of which are of "polyanthus" type, i.e. plants in which a number of blooms are borne on the same long stalk You may sometimes find this feature in the common sort, while the cowslip (*g.v.*) and oxlip are both of this type Other primulae



PIN EYED' PRIMROSES

In the primroses known as pin eyed the stigma is at the mouth of the corolla tube with the anthers half-way down, in others called thrum-eyed the positions of stigma and anthers are reversed Bees pick up pollen from the anthers of one type and deposit it on the stigma of flowers of the other type

H. Berlin

have a long stem, bearing numerous whorls of flowers and elongating as each lot comes into flower. The lovely auriculas, too, whose velvet-like flowers vary from a blackish-purple to pale green, also belong to this group.

Prince Edward Island, CANADA You could put this island nearly 300 times over into its huge neighbour, Quebec, yet it remains a fully-fledged province of the Dominion, to which it was admitted in 1873. Its greatest breadth is only 30 miles, and its length is about 120, making an area of 2,184 square miles. It is by far the smallest of the Canadian provinces, though the most densely populated.

The island is crescent-shaped, and lies in the Gulf of St. Lawrence in the curve of the great semicircle formed



PIONEER OF THE PRINTING CRAFT

Gutenberg is here seen showing a visitor the wonders of a printed sheet. Said to be the inventor of the art of printing with movable types, Gutenberg went into partnership with a rich burgher named Fust, who lent him money to set up a press. Owing to heavy expenses Gutenberg failed commercially and was forced to surrender his plant to Fust.

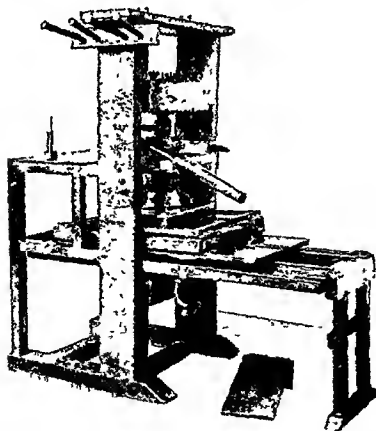
by New Brunswick and the peninsula of Nova Scotia. Protected by the sand-dunes which enclose the low-lying coast, it is practically all fertile land, and has been called "the Garden of the Gulf."

The prosperous farming population raises large crops of oats, potatoes, and turnips. Cattle, sheep, and pigs are reared, and the pork-packing and dairy industries are highly profitable. Fishing is, next to agriculture, the most productive calling. A flourishing industry is the breeding of silver foxes on ranches.

Busy tram ferries, plying across the narrow Northumberland Strait, connect the island with the mainland. Charlottetown, the capital (population, about 12,000), is situated on an excellent harbour and absorbs most of the trade of the province, which is a summer paradise for tourists.

The island was first discovered by Sebastian Cabot in 1497. Under the name of the Isle of St. Jean, it remained a French possession until captured by the British in 1768. In 1798 it was re-named in honour of Edward Augustus, Duke of Kent, the father of Queen Victoria. The total population is about 88,000.

Printing. Ages ago the Chinese learned that by carving letters or designs in relief on blocks of wood these could be inked and stamped or printed in reverse on sheets of paper. The oldest-known printed book was produced in China in 868 A.D. And in Europe also, about the year 1350, "block books" of a few printed pages began to be made. (See Books)



BENJAMIN FRANKLIN'S PRINTING PRESS

Franklin was apprenticed to a printer at the age of twelve, and learned his trade thoroughly. Above is a wooden hand-press such as he used in 1725, and differing little, probably, from that used by Caxton in the 15th century.

From an exhibit in the Science Museum, South Kensington

PRINTING

But this is not what we mean today by printing. As we use the term it means printing from *movable types*, which can quickly and easily be combined and recombined over and over again. There is all the difference in the world between the slow and clumsy "block book" work and modern printing.

In order that we might have the art of printing—rightly called "the art preservative of all arts"—several things were necessary. First, some way had to be found of making types of exactly the same thickness from the bottom of the letters to the top, so that they could be "locked up" without "piecing," as the printer calls it when the type falls out and spills. Second, the types must be exactly the same height, or some would print and others not when the paper was pressed down upon the "forme." And third, there was need of a cheap and rapid means of accurately reproducing each of the characters, so that the printer might have enough o's and a's and h's and all the other letters.

Only one way has ever been found for satisfying these three requirements, and that is by casting the type in metal in uniform moulds. So the invention of the *type mould* is really the invention of printing. And this

invention is now generally thought to belong to Johann Gutenberg, who was born in Mainz, Germany, of a good family, about 1400.

For something like 20 years Gutenberg was engaged in secret researches in Strasbourg and in Mainz, and much of this time he was probably engaged on his great invention. Many things had to be settled—the "matrices" for making the "faces" of the types, the mould for the "body", the right composition for the type metal, and the method of casting. And after all these questions were solved, there remained the construction of the press itself, paper-making, and printing and binding.

Types and presses no doubt were the "tools" to make which Gutenberg borrowed money from Johann Fust (or Faust) of Mainz in 1450. When he proved unable to repay the money promptly, Fust foreclosed on the mortgage and obtained possession of Gutenberg's types and presses (1455), with which he himself then set up as a printer, with the technical help of his son-in-law, Peter Schoeffer. As in the case of so many later inventors, others reaped most of the profit of Gutenberg's labours, and he died in comparative poverty about 1468.

Gutenberg's method of casting type seems to have been very much like that which is still



PAPERS POURING FROM THE REEL-FED ROTARIES

Modern newspapers and magazines, with their enormous circulations, would be impossible without the aid of such mechanical marvels as this. The Hoe rotary press, printing "The Daily Telegraph and Morning Post," can turn out as many as 40,000 copies an hour. You can see them coming down the conveyor belt, all carefully folded. The man in the centre is scrutinizing a copy for faults of inking, which will be instantly corrected by one of the men on the right. This type of machine is fed from giant reels of paper, which is printed on both sides between rotating cylinders.

PRINTING

used First, a "punch" of hard steel was made with the letter in relief in the end. With this a matrix for the face of the letter was punched in a bar of soft metal. This matrix was then used to close one end of the "monld" for the type body, while the molten mixture of lead and alloys was poured in at the other end. (See Type) The faces of the early types were made to resemble handwriting closely.

What is supposed to be the first complete book printed from type was the Latin Bible—known as the "Mazarin" Bible from its having been discovered in the library of Cardinal Mazarin, or as the Bible of 42 lines (to the page)—and it was finished in 1456. This may have been printed by Gutenberg or by Fust.

The whole subject of the inventing and early history of printing is full of disputes. The honour of the invention is claimed for a dozen or more persons, the chief rival to Gutenberg being Laurens Coster of Haarlem (Holland).

In 1462 the city of Mainz was captured and sacked, and its printers were dispersed to different German cities. Within fifty years printers had established themselves in more than 200 places in Europe, and books and leaflets were being turned out at a very rapid rate. The effect was greatly to cheapen books and spread broadcast culture and knowledge.

William Caxton, a native of Kent, was England's first printer. After learning the printing trade at Cologne he returned to England

PRISONS

in 1476, and set up his press in Westminster, in the precincts of the Abbey. In fifteen busy years he published about a hundred volumes.

The early printing presses were rude wooden affairs in which a "platen" was screwed down with levers so as to press a moist sheet of paper against an inked "forme" of type. The type was inked by patting it with stuffed feather balls daubed in thick printer's ink. This was a very slow and unsatisfactory process.

Later hand-presses, which were operated by a lever, were invented, and inkling by means of gelatine rollers was introduced. Rotary "cylinders" presses, operated by steam-power, were first used in England, about 1814.

Thousands of Newspapers in an Hour

The greatest marvels of all are the modern octuple rotary presses, which print, fold, and paste whole newspapers and magazines from continuous rolls of paper at the rate of 40,000 copies or more an hour. They are a development of American inventive ingenuity, largely that of R. M. Hoe, of New York, beginning about 1850. (See also Linotype, Monotype, etc.)

The skilled sections of the printing and allied trades can be entered only by an apprenticeship, which in most cases covers a period of seven years, from 14 to 21. It is necessary for parents who wish to apprentice their sons to the printer's craft to make early application to have their boys' names placed on a firm's list of prospective apprentices. It is not the custom to require

premiums, but naturally the apprentice's wage, to begin with, is usually very small. Instruction in printing is given to apprentices in London at the London School of Printing and Allied Trades, 61, Stamford Street S.E.1, and at the Central School of Arts and Crafts, Southampton Row, W.C.1. The L.C.C. also run various evening classes for printersevery winter.

Prisons AND PUNISHMENTS As soon as firm governments had become established in the world men began to realize that crime was really an injury to the State itself. The State imposed



JOHN HOWARD—PRISON REFORMER

Shocked by the defective arrangements of prisons in the 18th century, the English philanthropist, John Howard, spent his life in securing prison reforms. The illustration above, after Gairay, shows him relieving a poor soldier in prison. Not only in England but abroad he devoted himself to his task of inspecting prisons, and he died in 1790 of camp fever caught in Russia.

PRISONS & PUNISHMENTS

certain duties upon its citizens, and in return it was bound to protect their lives and their property. The murderer or thief became a public enemy, and it was therefore the State's duty to punish the criminal (See Crime and Criminals)

For ages offenders were made to "pay for their crimes by their own sufferings. While this feeling has not entirely died out in the popular mind, the laws of all civilized states have abandoned the idea of vengeance in their treatment of prisoners. Punishments are imposed now for three reasons:

(1) to protect society from criminals by putting them out of the way, either by death or imprisonment, (2) to discourage others from committing crimes by showing them the fate that waits the criminal and (3) to reform the criminal.

Torture was long used not only as a punishment but to extract confessions from the accused and to get evidence in legal trials. "Third degree" is a modern method of "mental torture" practised in the U.S.A. to extract information from suspected criminals or their associates. In England torture was never authorized by common law, though it was often inflicted under royal prerogative. Condemned men were executed in the most painful ways imaginable. Burning at the stake was the penalty for certain offences as late even as the 18th century, and frequently prisoners were tortured for days before their execution.

How the Condemned are Executed

The usual methods of execution today are hanging, the principal method in England, electrocution, or killing by an electric shock, practised in some parts of the United States, beheading, especially by the guillotine which is used in France, and shooting, the favourite method in Latin American countries.

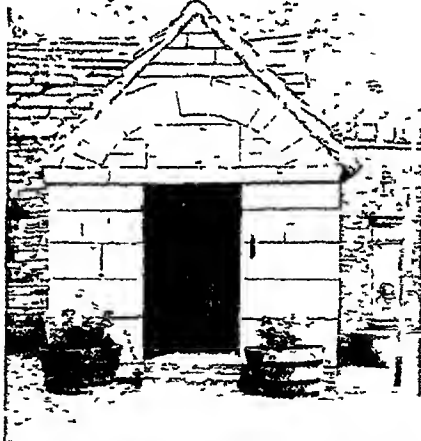
There has been a tremendous decrease in the last century in the number of crimes for which the death penalty is imposed. In 1765 in England there were, according to Blackstone, no less than 160 offences for which a man might be put to death, extending from the gravest crimes to petty thefts. Today, in nearly all civilized countries, capital punishment (as the death penalty is called) is used for only two crimes—treason and murder.

For minor offences there were formerly certain forms of punishment, such as flogging, branding with a hot iron, mutilation, etc. Niggard housewives were punished by the ducking stool,



chair fastened to a beam, by which the victim was ducked in a pond.

For offences like seditious libel, giving short weight, and brawling, a favourite instrument of punishment in England was the pillory, which confined the victim's neck and wrists while he was exposed to derision in a public place. Petty offenders were also put in the stocks, the culprit sitting with his ankles, and sometimes his wrists and neck, thrust through holes in boards. Though this punishment has died out, you may often see stocks in country villages. Deporting men and women convicted of even minor crimes to remote regions was



PUNISHMENT FOR PETTY OFFENDERS

Stocks, which consisted of two bunks of timber padded together so as to imprison the prisoner's feet in holes were last used in England in the middle of the 19th century. The upper photograph shows the still existing stocks (for two persons) at Havering-atte-Bower, near Romford. Immediately above is seen an old lock-up at Swanage.

Lower photo: Wmfred Brown

another punishment. Judge Jeffreys sent 1,000 prisoners to the West Indies as slaves, and the first settlements in Australia were largely peopled by convicts sent out from England.

When the practice of inflicting prison sentences first took root the condition of the prisoners

was deplorable in the extreme. Prisons were dark, fever-breeding, filthy dens, in which men, women, and children were crowded together without ventilation and with virtually no food except what friends supplied or the gaolers furnished for pay.

The credit for rousing the public conscience to the barbarism of such conditions belongs chiefly to John Howard (1726-90), whose horrifying pictures of prison life forced a change in the treatment of offenders. Scarcely less influential was the work of Elizabeth Fry (1780-1845) (See Fry, Elizabeth).

The new prison system developed in the early part of the 19th century, the aim now being to reform prisoners by humane methods, with particular attention paid to the psychological side. This system embodies two main principles: the separation of prisoners by individual cells, and their employment at some form of labour. Under the modern system it is often possible for a convict to shorten his term in prison by good behaviour, and frequently, upon recommendation by the proper authorities, a prisoner is released on "ticket-of-leave." This means that he is released upon certain conditions.

Young offenders are dealt with under the Children Act and are tried by Juvenile Courts. In many cases juvenile offenders are sent to industrial or reformatory schools like those under the Borstal Institution.

The prisons of Britain come under the jurisdiction of the Home Office.

Privy Council. Legally the British Cabinet (*q.v.*) is only a committee of the Privy Council, but the committee is now more important than the Council. All the members of the latter meet only at the beginning of a new reign or when the sovereign announces his or her coming marriage. Membership in the Council, which is for life, is often given to distinguished persons as a mark of honour, while all the Cabinet Ministers become Councillors by virtue of their office, and are likewise entitled to the prefix "The Right Honourable" and the letters "P.C." after their names. On appointment by the sovereign a Privy Councillor goes through the ceremony of kissing hands and taking an oath of allegiance.

The head of "His Majesty's Most Honourable Privy Council" is the Lord President of the Council, an important Cabinet Minister.

HOW *the* PICTURES in *this* BOOK *were* MADE

No one doubts that the pictures are always the most interesting part of any book. For that reason it is worth while knowing how "blocks" are made and how they get into the page.

Process Engraving. The illustrations now used most commonly in our books and magazines are made by what is technically known as the *half-tone process*.

In a photograph the light passing through a negative produces various tones on the sensitized paper, ranging from the lightest greys or browns to the densest blacks. But in ordinary printing only one kind of ink, usually jet black, can be used at a time. The difficulty of reproducing tones and shades was solved by photographing the design on to the printing plate through a glass "screen," ruled criss-cross with fine diamond-cut lines, often as many as 150 or 200 to an inch. These have the effect of "breaking up" the design into a multitude of fine dots of varying sizes, with white spaces of greater or less extent between. If you look at a photo-engraving, especially through a magnifying glass, you can readily see this "half-tone" appearance, which makes possible the representation of all tones and shades by one printing of black ink on white paper.

In making a half-tone printing block, the design is first photographed through the glass screen, and the negative thus obtained is then placed in contact with a sheet of polished copper coated with a preparation of fish-glue, bichromate of ammonia, with albumen and water.

Where the rays of light strike through the negative this coating is hardened, but elsewhere it remains soluble in water and can easily be washed off. An acid or other chemical bath then etches into the exposed parts of this plate, leaving only those parts of the surface which are to appear in the printed engraving. After mounting the plate on a wooden block to make it "type high," the plate or block is printed.

The size of the *meshes* of the screen used varies for different grades of paper. Newspaper half-tones are sometimes as coarse as 70 to 80 lines to the inch, while in very high-class book and magazine work the meshes may be as fine as 180-200 lines to the inch. The half-tone process very greatly improved the quality of book and magazine illustrations. It is the process by which most of the illustrations in this encyclopedia were made, and it is used to reproduce all photographs and "wash" drawings—that is, water-colour drawings in one tone.

Zinc etching is another photographic process much used to reproduce line drawings, that is, drawings in pen and ink. In this process no screen is used in photographing the drawing on to a sensitized zinc plate. The parts of the plate which correspond to the original design are hardened as solid lines or masses. After the soluble portions are washed away, and these lines

HOW FOUR ENGRAVED PLATES PRINT IN COLOURS

FOUR PLATES ARE USED AT THE TOP WE SEE EACH PLATE PRINTED SEPARATELY

1 The Yellow Plate

Actual printing begins below, with an impression from the yellow-ink plate

2 The Black Plate

Next, the black-ink plate prints on top of the yellow, producing this result

3 The Red (Magenta) Plate

The red-ink plate now adds its part of the picture to the yellow-black

4 The Blue-Green Plate

Last, the blue-ink plate prints over yellow - black - red, and the job is done

5 Yellow Plate Alone

6 Black on Yellow

7 Red on Black-Yellow

8 The Finished Picture

To make the four printing plates the photo engraver photographs the artist's drawing four times. One negative is made with a clear lens for the black, and one each with gelatine filters coloured blue-violet, yellow, green, and red orange (the primary colours of light). The plates which are the positives, are then prepared like ordinary half-tone engravings. Because the blue-violet filter absorbs yellow, the negative made with it shows more or less blank

areas wherever yellow forms all or part of a colour in the original drawing. Thus the positive printed through the blank places in that negative will be a record of those yellow areas and will be printed in yellow ink. In the same way the negative photographed through the green filter makes the magenta plate, and the negative produced with the red orange filter makes the blue-green plate. All but the very darkest areas are etched out of the black plate

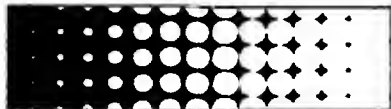


WHERE THE HALF-TONES IN THIS BOOK WERE MADE

LOOK at the array of cameras in the upper photograph! They are to be found in the Studio and Operating Room of the Amalgamated Press works in Southwark, London, and are used in the making of half tone blocks for illustrating books like this one. The photograph is pinned on the easel and evenly lit by lamps as you see. The camera is then moved along the rails until the image is exactly the required size. The negative will show the picture split up into dots of varying sizes, the larger dots being the shadows and dark parts of the picture. The lower photograph, also taken at the Amalgamated Press works, shows the Fine Etching and Engraving room. By the windows sit the retouchers, while in the foreground, at a proofing table, a workman is seen that a page is set square. By his side is a platen and roller used for "pulling" a proof.

are strengthened with a chemical substance known as "dragon's blood," the remainder of the plate is etched away, leaving the design in bold relief as in wood cuts. Half-tones and zinc etchings are often used in combination.

Photogravure is a wholly different process from the half-tone. In photogravure a sensitized paper, called carbon tissue, is exposed under a black-and-white "positive," made without a screen. This paper is transferred to the copper after exposure, and, the parts under the clear spaces having been hardened by the action of light, the other parts can be etched through into the metal. Then the design is cut into the



surface, as in etching and line engraving. A grain is obtained by first sprinkling the plate with powdered resin, made to adhere by beating. With this process there is an absence of sharp lines and dots, this results in a richness of texture which cannot be obtained in half-tone reproduction.

In photogravure printing the etching is done on a copper cylinder which is put in a suitable printing press, the cylinder revolving in a trough of greasy ink. As the plate leaves its inky bath, a sharp knife scrapes away all the ink but that held in the depressions. As the cylinder revolves, it comes in contact with a cylinder of rubber which presses down hard on the exposed cylinder. The dampened paper passes between the engraved surface and the rubber blanket, and the ink is forced on to the paper by the pressure of the rubber. The printed paper then goes over a steam drying cylinder. In principle this process resembles line engraving and etching rather than wood cut or half-tone printing. It is also based on the principle of the flat plate photogravure process, which it resembles in the effect produced. Many pages of this work are printed by this method, e.g. 2929-2936.

Of recent years *photo-lithography* has grown to be one of the most important branches of commercial printing. Zinc or aluminum plates, specially treated, have been found to be very satisfactory substitutes for the heavy lithographing stones, and they may be used on rotary cylinder presses. The plates are covered with a solution similar to that used to sensitize plates in other photo-mechanical processes, and after exposure the transferred design is covered with printing ink and the rest of the plate is treated to repel the ink.

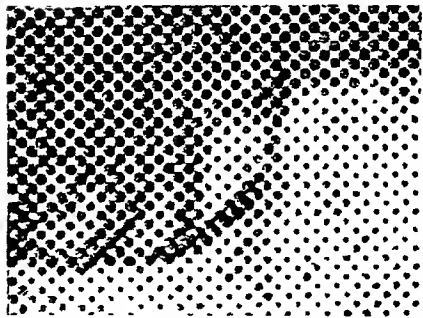
The *off-set method*, one of the processes now used in lithography, produces some really beautiful work, and the rotary machines do the work at much greater speed than was possible before they were invented. It is also employed on flat bed presses. In this process either zinc or aluminum plates are prepared, as in photolithography. There are three cylinders on the rotary press, one carrying the printing plate,

one with a rubber surface, and one carrying the white paper. The plate cylinder is inked and damped by two series of rollers, as used in all lithographic presses. The impression is printed by the plate on to the rubber cylinder first, which in turn prints or "offsets" the impression on the paper carried by the third cylinder. In this process the etched plate is prepared "right side to," and not "reversed" as in other printing.

If you stop to think a minute you will see that this must be so, because the design is printed *twice*—once

on to the rubber sheet and again when it is off set on to the paper. The off-set method prints well on any kind of paper, rough or smooth.

Of recent years exquisite *colour printing* has been done by lithography and the half-tone process, based on the theory that by printing successively the three primary pigments—red, blue, and yellow—practically any colour combination can be produced. The same principle is employed also in half-tone colour printing, a separate plate being made for each of the three primary pigments. By the use of coloured glasses, called the "light filters," in the camera when the object or painting is photographed, only the portions in red or its allied



SECRET OF THE HALF-TONE BLOCK

Above is part of a half tone block, greatly enlarged. The black portions are the parts of the copper which will receive the ink and transfer it to the printed page. The white portions are the etched hollows between, which catch no ink and so leave the paper white. The diagram upper left shows how by this variation of density all shades from almost pure black to almost pure white are produced.

MAKING A HALF-TONE BLOCK FOR THIS BOOK

Half-tones are made by photographing an object or picture through a screen, and then transferring to a metal plate the photographic image which is obtained on the negative. The metal plate becomes the half-tone. The screen is made of two pieces of glass, cemented together after each plate has been ruled and the ruled lines filled with a black opaque substance. The screens used for half-tones in this book have 120 lines to the inch. Newspaper half-tones usually have 60 to 80 lines

This shows a screen, with one corner greatly magnified. The best results are obtained from a cross-line screen, which breaks the solid tones into a multitude of fine dots. Each time before use the screen must be carefully rubbed to remove any dirt or ink.

3 Here you see how the photographic image is transferred to the metal. The negative is placed in contact with a copper plate, which has been coated with a sensitized preparation of fish glue, hydra-mate of ammonia and albumen. A powerful light is then turned on the negative and the plate. Where the light strikes the copper through the negative, the sensitized coating becomes hardened, where light does not strike, because the lines made by the screen interfere, the coating may be washed off in water. After the image is produced on the copper, it is carbonized or "fixed" by heating over a gas flame. It is then ready for etching.

2 Here you see the copy in place before the camera, and the inverted image in the back of the camera. By turning the handle the photographer moves the camera forward or backward, until the image is exactly the required size. The negative, which is developed like any photographic negative, will show dots of varying sizes, the larger dots being the darker parts of the picture. The next step is to transfer the image to the metal plate.

4 Here the plate is in the etching bath. The acid, carefully spread over the plate, eats away the copper surface where it is not protected by the hardened photographic image. Thus the dots made by the screen are preserved on the copper.

5 This shows the last steps, when hand work is needed to remove any imperfections in the etched surface.

shades appear on one negative, only the yellow on another, and only the blue on a third. When plates are made from these three negatives and printed one over another with transparent ink, the colours blend themselves into a reproduction of the original painting. The many colour plates in the volume you are reading have been printed in this way (See also Engraving, Printing)

Prometheus. The Greeks were one of the first peoples to picture a hero who, at the cost of suffering to himself, helped to make humanity's condition better. Prometheus, their legend told, was one of the Titans, a mighty race of demigods. When men had fallen into a brutish state and the wrath of Zeus was aroused against them, Prometheus came forward as their champion. He uplifted them, taught them the useful arts, and even stole fire from heaven for their use.

For this Zeus punished him by chaining him to a lonely rock in Scythia. Here he remained for ages, while an eagle devoured his liver which grew again by night, thus prolonging his torture. He possessed a secret which threatened the rule of Zeus and for which Zeus offered him his freedom, but Prometheus refused. He chose rather to endure his torment until he was released by the great hero Heracles (Hercules).

One of the greatest Greek tragedies, the 'Prometheus Bound' of Aeschylus, describes powerfully and dramatically the strength of the hero and the awful torture which he endured. One of Shelley's most famous poems is 'Prometheus Unbound.'

Pronoun. Pronouns—words used in place of nouns—save us a great deal of wearisome repetition. Instead of naming over and over again the persons or things we are talking about, we use such short words as *you, he, she, it, them, we, I, they, etc.*

The most important kind of pronoun is the *personal* pronoun. A personal pronoun indicates grammatical person by its form alone—as *I, we, you, us, them, it*. In grammar the term *person* means the property of showing whether a word refers to (1) the speaker, (2) the person or thing spoken to, or (3) the person or thing spoken of. The word is thus said to be the first, second, or third person—as first person, *I*, second person, *you*, third person, *he, they*.

Other kinds of pronoun are also said to be in the first, second, or third person, according to their meaning in a sentence. For example, the pronoun *who* is in a different person in each of the sentences that follow. 'I *who* speak unto you am *he*' (first person), 'You *who* listen must decide' (second person), 'The *who* works will succeed' (third person).

The personal pronoun, however, is the only kind that shows grammatical person by its form, when standing alone. Besides person, pronouns also have the other properties which belong to nouns—*gender, number and case*. (See also article on Nouns)

Other important kinds of pronoun are the *interrogative*, the *demonstrative*, and the *relative*. An *interrogative* pronoun is a pronoun used to ask a question—as 'What is that?' A *demonstrative* pronoun is one that points out some particular person or thing—as *this, that*. A *relative* pronoun is one used to join a clause to a substantive—as, 'It's a long lane that has no turning.' *Who, which and that* are the most common relative pronouns. (It should be noted, however, that each of these words has other uses)

The relative pronoun *who* is used to refer to persons, the relative pronoun *which*, to things or ideas, the relative pronoun *that*, to persons, things, or ideas. A relative pronoun has two uses in the sentence as a connective: it joins its clause to its antecedent, that is, the word to which it refers, as a pronoun it is used in this clause like a noun. In the sentence above, the relative pronoun *that* joins the clause 'that has no turning' to the noun *lane* and is used as the subject of the clause.

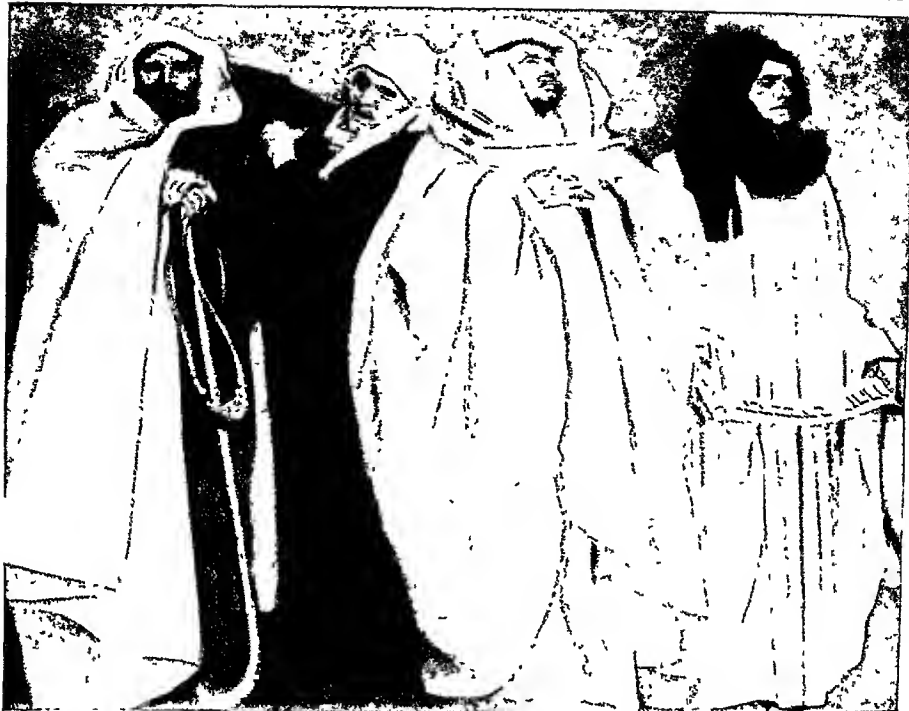
'Cases' of Pronouns

Five personal pronouns, and the relative or interrogative pronoun *who*, each have separate forms for the nominative and the objective cases, as follows. *I, me, he, him, she, her, we, us, they, them, who, whom*. They also have possessive forms—as, 'My book, your dog, his duty, their pleasure,' etc. Some of the personal pronouns have separate possessive forms which are used when the pronoun is to stand alone—as *mine, yours, hers*.

The declensions of the personal pronouns are as follows:

	FIRST PERSON		
	Singular		Plural
	Nom Poss Obj	I my, mine me	we our, ours us
	SECOND PERSON		
	Singular		Plural
	Nom Poss Obj	you (thou) your, yours (thy, thine) you (thee)	you (ye) your, yours you
	THIRD PERSON		
	Singular		Plural
	Nom Poss Obj	Male she his him	Neut it its them

The relative pronoun *who* has the same forms for both singular and plural: nominative, *who*, possessive, *whose*, objective, *whom*. The only other pronouns commonly inflected are *this* and *that*, which have as plural forms *these* and *those*.



FOUR OF THE PROPHETS OF THE OLD TESTAMENT

These figures from the "Frieze of the Prophets" by John S Sargent, represent in the order named, Amos, Nahum, Ezekiel, and Daniel. Amos, the humble herdsman, carries his staff and shepherd's sling, Nahum with arm outstretched is prophesying the downfall of Assyria and Nineveh, Ezekiel is the only major prophet of this group, Daniel was a hero as well as a seer, and "a man greatly beloved"

The number and gender of a pronoun are determined by the nature of its antecedent. If the antecedent is of common gender, the masculine pronoun is used—as "*Each of the children held up his hand*". *Each, every, either, neither*, though they always suggest more than one, are singular when used alone or with singular nouns, since they always mean *one at a time*. Therefore singular pronouns should be used referring to them. In the sentence above, for example, "*Each of the children held up their hands*" would be incorrect.

Prophets. We commonly think of a prophet as one who foretells future events, but as used in the Bible the word has a deeper meaning. In the Bible a "prophet" is one who speaks for God. Hebrew prophecy is sometimes said to

begin with Moses, who in after-times was regarded as the first and greatest of the prophets.

In a special sense the title belongs to those great Hebrew reformers and leaders who, in times when the people of Israel had fallen into evil ways, sternly and fearlessly rebuked them, or to those who, in times of great national disaster, strengthened their faith by assuring them of God's mercy. Such was Elijah.

Later we find a succession of inspired leaders, who were writers as well as teachers and men of action, and whose words have come down to us in those parts of the Bible known as the Prophets. The first of these "literary prophets," as they are sometimes called, was Amos, a simple herdsman from Tekoa, who dared to denounce the men of wealth and power, living in luxury built

upon the poverty of the people. Then came Hosea, pleading fervently with the people to remain faithful to Jehovah, and Isaiah, with his sublime vision of the day when the God of Israel should be worshipped by all the world.

Another great prophet was Jeremiah, who arose in the dark days before the Babylonian conquest. He was hated because he announced the impending doom of Judah, and was held to be a traitor because he set loyalty to God above loyalty to king and country. Jeremiah was followed by Ezekiel, who was among the captives carried to Babylon. Like other prophets, he was stern in condemning the wickedness of his nation, but he likewise brought consolation by picturing the new life that Jehovah would breathe into the dry bones of His people Israel.

The prophet Daniel is the hero of the biblical book which bears his name. Carried captive from Jerusalem to Babylon, he won the favour of King Nebuchadnezzar through his wisdom and ability to interpret dreams, and became one of the chief rulers in the Babylonian kingdom. When "Darius the Mede" captured Babylon, Daniel continued in high position until jealous princes contrived to have him thrown into a den of lions, where he was miraculously preserved. (See picture p. 1218)

The "Law" and the "Prophets" are two great divisions of the Old Testament as arranged by the Jews. The Law comprises the five books of Moses, and the Prophets consists of the "major prophets"—Isaiah, Jeremiah and Ezekiel—and the 12 "minor prophets" (so called because of their brevity)—Hosea, Joel, Amos, Obadiah, Jonah, Micah, Nahum, Habakkuk, Zephaniah, Haggai, Zechariah, and Malachi. The remaining books are classed as "Hagiographa" or "Holy Writings." The Book of Daniel is placed in the Jewish Bible in this last group. (See Bible, Jews)

Protective Coloration. Have you ever wondered why a tiger is striped, or why some animals turn white in the winter, or why some caterpillars look just like the twigs of the

trees on which they crawl? All these are examples of what is known as protective coloration, the system by which Nature in countless instances guards wild life.

Generally this protective colouring is used solely as a defence against enemies. Thus the hungry bird in nine cases out of ten passes over the caterpillar, completely hoodwinked by its twig-like appearance. The bluish colouring on the backs of fishes serves a similar purpose in securing them against danger.

Sometimes, however, it serves the further purpose of a disguise to enable the animal to catch its prey. The stripes of the tiger, which

seem so vivid when we see them at the Zoo, make it almost invisible to its victims in the jungle, amid the streaks of light and shade of the tall grasses. And many an unsuspecting swamp-loving animal has regretted jumping upon what looked like a log and turned out to be a crocodile.

It seems plain that the most useful colouring for an animal whose life is continually threatened by dangers would be the one which could least easily be seen, and countless races of animals have gradually obtained such a coat—sometimes in amazing perfection. The most unmistakable examples are to be found among the

most helpless—those who have little or no other means of defence, and this seems to show that it is by this "safety first" feature that they have managed to continue to survive in a world of merciless warfare.

Almost all the small swimming creatures in the sea, and the fry of many fishes, are transparent, so that they are quite invisible in water, as glass. Nearly all fishes, a group of animals whose only means of defence, as a rule, is in flight, are bluish on the back—a tint not readily seen under water. Going to the opposite extreme, we find that creatures of the deserts, whether large or small, are usually the colour of soil or sand. The same is true of the hosts of insects that live and feed amid the foliage of



PUZZLE FIND THE HARE

Nature provides birds and animals with protective colouring as a defence against their enemies. See how difficult it is at first glance to spot this young hare or leveret as it is called. The colour and markings of the fur blend so naturally with the surroundings that the animal is almost invisible.

trees and bushes or in the grass, matching it by their green or green-mottled coats, and those that live on heathlands are speckled dark brown.

It is only when they move away from their natural surroundings that such members of the animal kingdom are seen. In some young animals the instinct of "lying low" is so strong that you may pick them up—if you can find them—and they will not show they are alive!

Protected while Asleep

This brings out an important point, namely, that in many cases the "protected" animal is in no great danger when it is wide-awake and active. It profits most by its colour when at rest or asleep. Protective coloration is chiefly of value to birds when they are sitting on their eggs, and this explains why it is that in so many kinds of birds the female wears a very plain dress while her mate is gaudily feathered.

The gay fathers of the families can take care of themselves pretty well, for they are free to fight or flee when danger threatens, but the mothers must sit steadily on their nests, where they might quickly be seen and pounced on by some prowling cat or other bird-killer were they wearing bright colours. If this is true of those birds which nest under the cover of leaves, how much more is it true of those whose nests are on open ground. Not only does the mottled back of the sitting mother in such cases so blend with the earth and weeds about her that she usually escapes notice, but even her brown eggs are all but invisible when exposed by her absence. In many such birds, the male is as well disguised as the female, for he, too, often takes his turn on the eggs. Such enemies as do find the nest are guided probably by smell.

The partridges are streaked dark brown and buff or grey, like the dry grass in the fields, the hithens are more broadly striped, like the reeds and sedges of the reed-beds, the woodcock is mottled brown and buff, like the dead leaves of the woods it frequents, and so on.

Queer Effects of Shading

But Nature has gone even further than this. Artists have long known how to make objects stand out on the canvas by *counter-shading* the under-side to imitate a shadow thrown by a solid figure. The exact opposite of this principle is applied to birds and animals, causing them to become difficult to see by destroying the appearance of shade on their under-parts.

This is brought about by their being coloured lighter below, in exact proportion to the amount of shade received, so that they are practically pure white on the middle of the belly, with a gradual change to the dark upper parts.

Another very different principle of protective coloration is that called *ruptive marks*, in which conspicuous black and white marks are placed close together. Examples of this principle are

found in the white ring round the neck of the mallard duck or the ringed plover. Such marks seem to cut off the head of the bird, or to break up the bird into several pieces, thus destroying its continuity of form. In this way the eye of the enemy is attracted to some one part rather than to the bird as a whole, and the latter appears like some other object.

Yet further examples are to be found in those birds and animals whose coats turn white in winter, so that they harmonize with the snow that covers their mountain homes. Among insects, types of protective device are innumerable and you will find these described and illustrated under Insects (*q v*).

Proteins. (Pron *piō'-te-inz*) In order to grow and to repair the wear and tear that is constantly going on in the tissues, every living thing must have a constant supply of proteins. Proteins differ from all other kinds of food substances in that they contain the nitrogen that is necessary to life. It is the most important type of food, and that is why it was given its name, which is derived from a Greek word meaning "first."

However much a man may be supplied with sugar, fats, starch, and salts, he cannot live without proteins. And while sugar and fats are better fuel for the body, proteins supply fuel also, and maintain life without fats or carbohydrates.

Proteins are built up of simple substances called "amino-acids." During the process of digestion we break down the proteins in our food into these amino-acids, which are able to dissolve in the blood, and thus be carried to the muscles and tissues where they are needed and built up into the particular protein required.

The greater part of the solid matter of all animal cells and tissues, and also various parts of the structures of plants, particularly the seeds, are made up of various kinds of proteins. Most plants—those that have green colouring matter, or chlorophyll—can make protein for themselves, but all animals and human beings and those plants which, like the mushroom, contain no chlorophyll, must obtain it ready-made. There are nearly 40 different kinds of vegetable and animal protein, most of which are suitable for Man.

Some of the well-known members of the protein family are the gluten of wheat, albumen of eggs, casein of meat, casein of milk, and legumine of peas and beans. The dried white of an egg is an almost pure protein called albumen, so is the gummy mass left after wheat is chewed for a long time. Plant sources rich in proteins are wheat, oats, peas, beans, lentils, and nuts. The chief animal sources of protein are meat, milk, eggs, and cheese.

The serum of bacteria used for injections contains protein. When this is injected into

STRANGE EXAMPLES OF NATURE'S CAMOUFLAGE



The Nassau grouper, like some other tropical fishes, turns dark when alarmed (1) and makes for a shadowy hiding place. Normally (2) he is brilliantly coloured. Can you find the stick insect (3), or see the two nightjars (5), or even discover the seven Indian leaf butterflies (6)? In the centre picture you see the fate of a peccary which mistook an alligator for a log

PROTEINS

a person's body antagonistic substances are formed to deal with it. If a second injection is given some weeks later, those substances rise in revolt, raising the patient's temperature, and sometimes even causing death. This artificial fever has been successfully made use of as "protein shock therapy" in the treatment of rheumatism and similar diseases.

Continued over-eating of protein is harmful and may lead to serious ills, for while we can store up as fat an excess of sugar and fats that have been taken into the body, we cannot store up protein. Now, the breaking

up of proteins in the body is difficult, as they are so very complicated in their chemical composition, and many of the products of the breaking-up process are poisons. So to keep in perfect health it is necessary that our diet be well balanced, containing only the protein supply which we need, with a proper proportion of fats, carbohydrates, and mineral salts. (See Food)

Proteus. (From *prō'-tūs*) The ancient Shepherd of the Deep lay at noon in his hollow cave by the ocean's shore, and all about him slumbered the well-guarded sea-calves, or seals, as we should call them, which the god Poseidon had entrusted to his care. But four of his flock had secretly been slain, and in their skins lay hidden King Menelaus and three of his trusted followers.

These survivors of the great Trojan War had come to wrest from Proteus the secret of the contrary winds which kept them from their far distant homes.

When Proteus, having counted his flock, lay down to rest, Menelaus and his men threw off the skins and seized him. Then Proteus's hair became transformed into a mane and his body into that of a raging lion. But his captors did not relax their grasp, for they knew his cunning wills. Then he sought to writhen out of their hands as a snake. Next he became a leopard, and then a fierce wild boar. Even when he took the shape of running water, and

PROTOPLASM

of a tall and flowering tree, they held him fast. At last, wearied of the struggle, Proteus resumed his proper form and revealed to Menelaus how by sacrifice he might appease the wrath of the gods and be granted favourable winds to waft him homeward. When questioned further, he told how Agamemnon, the brother of Menelaus, had met a treacherous death, and how the other leaders of the Greek hosts fared. Thus having spoken the ancient one was released and plunged into the sea.

Such is the old story which Homer tells of Proteus. He was one of the many lesser

divinities that followed in the train of the sea god Poseidon (Neptune), and perhaps typifies this ever-changing aspect of the sea. His name has given us the adjective "protean," which means "variable." In later stories Proteus is Poseidon's son. He is also a king of Egypt.

Protoplasm.

The fairy godmother of every living thing—of plants and animals and ourselves—is a drop of magical jelly that we call protoplasm. It gets its name from two Greek words which mean "first material," because it is the "stuff" out of which every living thing is made.

This protoplasm is really the only thing in the universe which is alive. Plants and animals are alive, because they are made up of this wonderful life substance, but minerals are not, because they have no protoplasm.

What is it to be alive? A bit of cloth or blotting-paper can soak up water, but it cannot use it or make anything out of it. A silkworm eats mulberry leaves, grows larger on this food, makes a silk cocoon to sleep in, and hatches out into a moth that lays more eggs. In being alive it eats and grows, and makes more living things like itself. That is why we know that the little drop of protoplasm which constitutes the amoeba is alive. It is the smallest, simplest living thing in the world. (See Amoeba, Cell)

Chemically, protoplasm consists chiefly of carbon, hydrogen, nitrogen, sulphur, and oxygen. In



EVER-CHANGING PROTEUS

According to Greek mythology, Proteus had the power to foretell the future, but was always reluctant to exercise it. When asked to prophesy he assumed all sorts of shapes to escape his questioner, but if anyone were bold enough to seize him and bind or keep hold of him through all his changes of form, he would eventually resume his normal shape and tell what was asked.

Engraving by B. Picart photo Mansell

active living cells protoplasm is usually a colourless hubblebuck fluid, which is seen under the microscope to be in ceaseless motion. In cells at rest, such as seed cells, it becomes much harder, sometimes as hard as bone. The thinner, more watery protoplasm surrounding the nucleus of the cell is usually called *cytoplasm*.

Protozoa. If you take a glassful of water from a stagnant pond and look through it towards the light you will see a multitude of tiny creatures. If you take a single drop of this water and examine it under a powerful microscope, you will find that it contains a number of still smaller creatures, so small that a single drop of water is a whole world to them.

They are the lowest forms of animal life and are called "protozoa," from the Greek words meaning "first living things." Each one is a complete little animal, though it is composed of only a single cell. One of the commonest of these single celled animals is the amoeba.

Tiny as the protozoa are, some of them actually build a little house or shell for themselves out of lime, or some similar substance, which they make in their own bodies. These are the *foraminifera*. If you examine them under the microscope you will find that their shells are often just as intricate and beautifully made as the large shells you pick up by the seashore.

Through many centuries the little shells of the foraminifera have fallen to the bottom of the seas, and in this way our great chalk cliffs have been formed. The *infusoria* are still another branch of the protozoa. They possess little hairs to swim with, and some of them actually have mouths. These hairs which are arranged in batteries are known as *cilia*. If they are only few and long and whip like, they are called *flagella*—little whips.

Many protozoa live as parasites on higher animals, including Man, and often cause dangerous diseases. For instance, malaria, yellow fever, and sleeping sickness are caused by forms of protozoa which find their way into the blood and other parts of our bodies. (See Cell, Germ Theory of Disease)

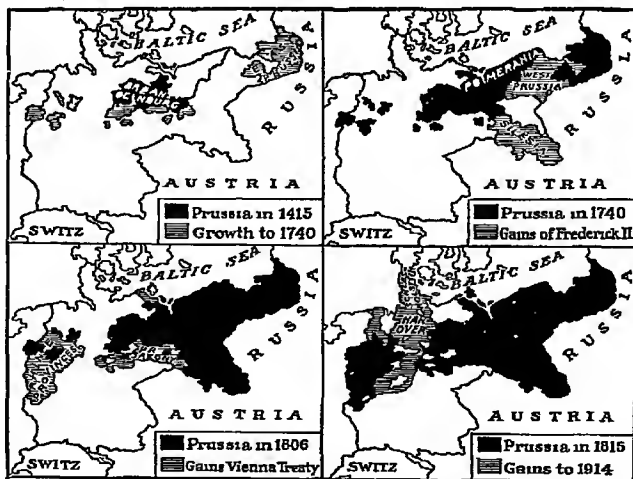
Prunes. Prunes are plums of certain varieties that can be dried whole—that is, with the seeds left in. They are among the most nutritious of foods and are extensively cultivated in France and other European countries and in the U.S.A. The kind known as French plums comes from the valley of the Loire in France. To produce a high grade of prunes, the plums must be meaty and have a high percentage of sugar.

The plums are left on the tree until they are so ripe that they fall to the ground. Then they are gathered, graded, and cured by sun drying or in evaporators.

When dry, the prunes are put in bins or piles to "sweat," and after two or three weeks they are ready to be graded and packed. They are graded according to the number required to make a pound. The choicer grades are packed like dates, and are eaten raw, but most grades are cooked before eating.

The prune is supposed to have been introduced into France from Turkey or Persia near the close of the Crusades. (See Plum)

Prussia, GERMANY. The ruins of the old castle of Hohenzollern, from which the former ruling family of Prussia took its name, may still be seen as the centre of a narrow little strip of Prussian territory in the far south-west of



PRUSSIA'S GROWTH THROUGH FIVE CENTURIES

The history of Prussia may be said to begin in 1415, when the Hohenzollern family gained possession of the little electorate of Brandenburg. For two centuries there was little indication that this country was destined to be the nucleus of the greatest of the German states, but after the Hohenzollerns had acquired East Prussia in 1618 their dominions steadily grew until they included two thirds of the territory and three-fourths of the people of Germany.

PRUSSIA

Germany, near the headwaters of the Danube. But what a contrast there is between those days of early weakness and Prussia's military might at the beginning of the War of 1914-18.

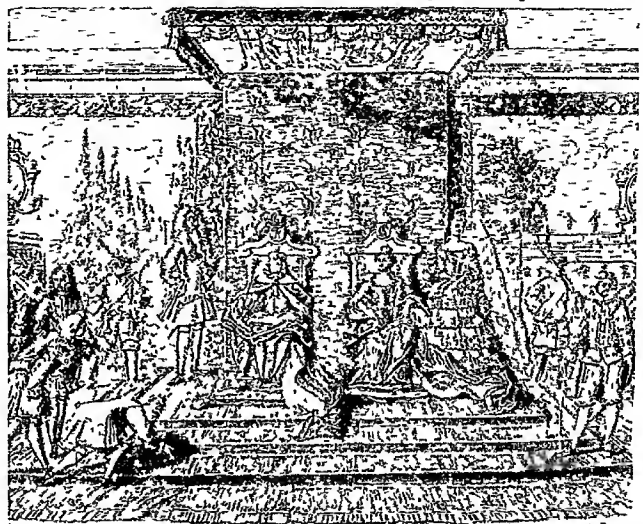
Three factors produced the power of the Prussian kingdom—the able and unscrupulous Hohenzollern dynasty, the "mark" (border territory) of Brandenburg, with Berlin as its capital, and the duchy of Prussia, lying beyond the Vistula River in lands conquered in the 13th century by the crusading order of Teutonic Knights from a heathen people akin to the Slavs (*Boissians*), and made a secular duchy at the time of the Reformation (1525) under a collateral branch of the Hohenzollerns.

The first great forward stride of the main line of the family was made in 1415 when Frederick of Hohenzollern used the wealth which he gained as "burggraf" of Nuremberg to buy from the Emperor Sigismund the rule over Brandenburg. Its possession made the Hohenzollern prince one of the "seven electors" of the Holy Roman Empire. But Brandenburg, lying in the northern plain between the Elbe and the Oder rivers, was a poor flat country with barren sand-hills heaped up by the cold winds. Gradually its Hohenzollern margraves (German *Markgrafen*, or "border counts") increased their territory—not thward at the expense of Pomerania and Mecklenburg, and southward at the cost of the Saxon marks. In 1609 the acquisition of some small isolated territories on the middle Rhine gave them a footing in western Germany.

The third important factor was added in 1618, when the duchy of Prussia fell by inheritance to the margrave of Brandenburg. It was the task of "the Great Elector," Frederick William (1640-88), and of his successors to consolidate, and strengthen these scattered possessions into a strong military state. Long wars with the Slavs and the absence of defensible frontiers had already given a military stamp to the Brandenburg-Prussian power. The Great Elector's son, Frederick I, won the title "king in (of) Prussia" in 1701. His son, the rough

father of Frederick the Great, who succeeded to the Prussian throne in 1713 and reigned for 27 years, is chiefly remembered because of his fostering care of the Prussian army, and for the regiment of giants that he recruited.

What could be done by the unscrupulous use of this Prussian military power was shown by Frederick the Great (Frederick II) in his long reign from 1740 to 1786. The territory of Prussia was almost doubled by the conquest of Silesia.



CROWNING OF THE FIRST KING OF PRUSSIA

On January 18, 1701, Frederick III, elector of Brandenburg, was crowned at Königsberg as King Frederick I of Prussia. This engraving, by Johann Wolfgang (1664-1748), shows the king enthroned with his queen consort, his second wife, Sophie Charlotte. She was a sister of George I of England, and one of the most cultured princesses of the age.

from the young and beautiful Maria Theresa of Austria, and by the annexation—though the first partition of Poland—of West Prussia, which separated the duchy of Prussia from Brandenburg. Incidentally Frederick helped to confirm in Prussia that feeling in aggressive war as its "national industry" which lay at the root of Germany's part in the World War of 1914.

But when Prussia measured arms with Napoleon on the field of Jena, in 1806, her armies were crushed. The reorganization carried on by Baron Stein and others enabled Prussia to take her part in the final overthrow of Napoleon in 1813-15, and as a result her territories lost to the French were restored and enlarged. A *Zollverein* or customs-union helped to pave the way for a political unity of the German states under

Prussian headship. As a result of revolutionary movements of 1848-49 the Prussian king granted a constitution to his kingdom which, however, contained comparatively few democratic features.

Bismarck's unscrupulous diplomacy in provoking war with Denmark in 1864, with Austria in 1866, and with France in 1870, brought Prussia increased territory and the coveted German leadership (See Franco-Prussian War). Schleswig-Holstein, the kingdom of Hanover, Nassau, Hesse-Cassel, and Frankfurt-on-the-Main were all absorbed into Prussia, and the Prussian king was in 1871 proclaimed emperor, as William I, of the new German Empire. Thenceforth the history of Prussia is merged in that of Germany (*qv*).

After the World War Prussia was still the most powerful State of Germany. Its area, including Waldeck, absorbed in 1929, is 114,000 square miles. It still contains the chief industrial regions of Germany and more than a score of cities of over 150,000 population, including Berlin (the capital of Germany), Cologne, Essen, Breslau, Frankfurt, etc., etc. A republican form of government was set up in 1918. In 1933, however, the Diet was abolished and Prussia was placed under the rule of a Governor, Adolf Hitler himself, while his lieutenant, Gen. Goering, became Prime Minister. The population of Prussia is about 40,000,000.

Psycho-analysis. The forces that play upon our minds and unconsciously affect our actions have been studied by a special school of psychologists known as psychoanalysts. Psychoanalysis means, primarily, analysing the mind. Technically, however, it implies that the analysis goes so deep as to unravel the tangled tendencies of which the person is himself largely unaware. It has proved of great practical use in the study of certain kinds of nervous disorders, especially hysteria. An instance may be given of a case studied by Freud (*qv*), the founder of psychoanalysis.

A girl suffered from a form of paralysis which prevented her from moving, or even feeling, the right side of the body. In addition, she had great difficulty in drinking water. There was no organic disease of the brain or nervous system to account for these symptoms, but, by special methods, it was possible to follow her mental history and trace each of the symptoms back to an emotional origin. Under treatment she recollected that when sitting in a hot garden she suffered from an intolerable thirst. A governess, whom she secretly detested, offered her a glass of water from which a dirty puppy had just been drinking. A wave of disgust swept over her, which from politeness she repressed. She forgot the incident, but afterwards, the sight of water aroused in her a feeling of sickness so intense that she could not drink. When the

buried memory was revived by the treatment of the doctors, the girl suddenly understood the real meaning of the symptoms and they disappeared. This is typical of many cases in which cures have been effected by psychoanalysis.

Freud at first used hypnosis (*qv*) in his treatment, but later gave it up for what is called the "free association method," which is the foundation stone of the present Freudian technique for the treatment of mental disorders. In this method the patient refrains from concentrating on any particular subject of thought and simply allows his thoughts to wander freely, relating to the physician whatever happens to come into his mind, however embarrassing or trivial it may be. This Freud supplements with dream analysis, asking the patient to recount his last night's dream and, prompted by the physician, to let his mind play freely about each item of the dream with a view to disclosing the buried memories which underlie the patient's symptoms.

Some former disciples of Freud, notably Dr. Alfred Adler, of Vienna, and Dr. Carl Jung, of Zurich, have come to differ from Freud, and have started schools of thought more or less in opposition to him. Adler started what is called the modern school of *individual psychology*. He starts with the mental life of the patient—his style of life, as he calls it—and from this passes on to examine such experiences as the feeling of inferiority with its reactions. He lays great stress on the "inferiority complex" (*qv*).

Dr. Carl Jung (*qv*), on the other hand, is the leading exponent of what is called *analytical psychology*. In his views, the primeval urge is derived from the collective inheritance of the racial ancestors. Jung sees in the phenomena of dreams a reflection of the dreamer's type rather than his repressed desires. In his view dreams may provide a valuable clue to the understanding of the patient's development, and help the psychologist to effect an improvement by encouraging his particular creativeness.

Psychology. The science of psychology is concerned with the study of the mind, and how it acts and works. By reason of its wide interest and manifold applications this study should appeal to everyone. Unfortunately, psychologists have found it necessary to invent strange technical terms which puzzle and often "put off" the uninitiated, and even when he does persist the student is often disappointed to find that there is little agreement among psychologists themselves, each "school" defending its tenets against other schools. All that will be attempted here is to give some idea of the substance and applications of the science.

Every conscious process has three main aspects—*knowing, feeling, and willing*. Thus as you read this page you see the printed words

PSYCHOLOGY

The words in turn suggest memories, thoughts and speculations. You grasp the meaning of each statement, and perhaps doubt or criticize them. All these are, in the main, intellectual or "knowing" processes. At the same time you are experiencing certain feelings, sometimes pleasant, sometimes unpleasant. If you come across a complicated statement which you cannot easily understand, you feel balked and annoyed. When you agree with an argument or come across a piece of knowledge which appeals to you, you feel contented and satisfied.

Finally, there is in most mental processes a purposeful or "willing" aspect, though you may not always be conscious of it. You may, in reading this, vaguely wish to improve your



PTOLEMY'S MAP OF THE WORLD

Ptolemy was as celebrated a geographer as he was an astronomer and mathematician. Above is shown the map of the world as drawn by him about A.D. 150. Though inaccurate as far as the East is concerned, and only roughly correct on the north-west European coast, this is a more reliable picture of the Northern Hemisphere than some of the medieval maps made 1200 years later.

knowledge of yourself or of other people. Or you may want to solve a difficulty that has been puzzling you.

In the past, psychologists have been chiefly concerned with the cognitive or "knowing" processes. Only within recent years has the study of impulse and emotion come to the fore. When a man goes mad we usually say he loses his reason, we now realize that, as a rule, a man only loses his reason because his emotions run away with it. We have only just begun to realize that most forms of inefficiency—absent-mindedness, loss of memory, even criminality and vice—are due not so much to lack of knowledge or intelligence, as to uncontrolled impulses or feelings.

In education, psychology has been of the greatest service—first, in the study of individual differences among children and, secondly, in determining the best methods of teaching

PUEBLO

and training. *Industrial psychology* has developed along two main lines—time and motion study, and vocational psychology. Time and motion study deals with the general and special conditions of industrial work, and endeavours to discover what are the most efficient and least fatiguing ways of carrying out particular trade processes. Vocational psychology is concerned with finding out, by means of tests, the best man for any particular job, or the best job for any particular child on reaching school-leaving age. (See *Industrial Welfare*, *Intelligence Tests*).

Ptolemy. (CLAUDIUS PTOLEMAIUS) (Pron. tol'-e-mi) (Died c. A.D. 161). The most famous astronomer and geographer of the ancient world

may or may not have been a member of the royal Ptolemaic house of Egypt (q.v.). All we know of him is that he was a native of Egypt and lived in Alexandria, and probably died soon after the year A.D. 161.

Ptolemy was a compiler rather than an original thinker or investigator, but he did his work so well that his books remained the standard text-books down to the close of the Middle Ages.

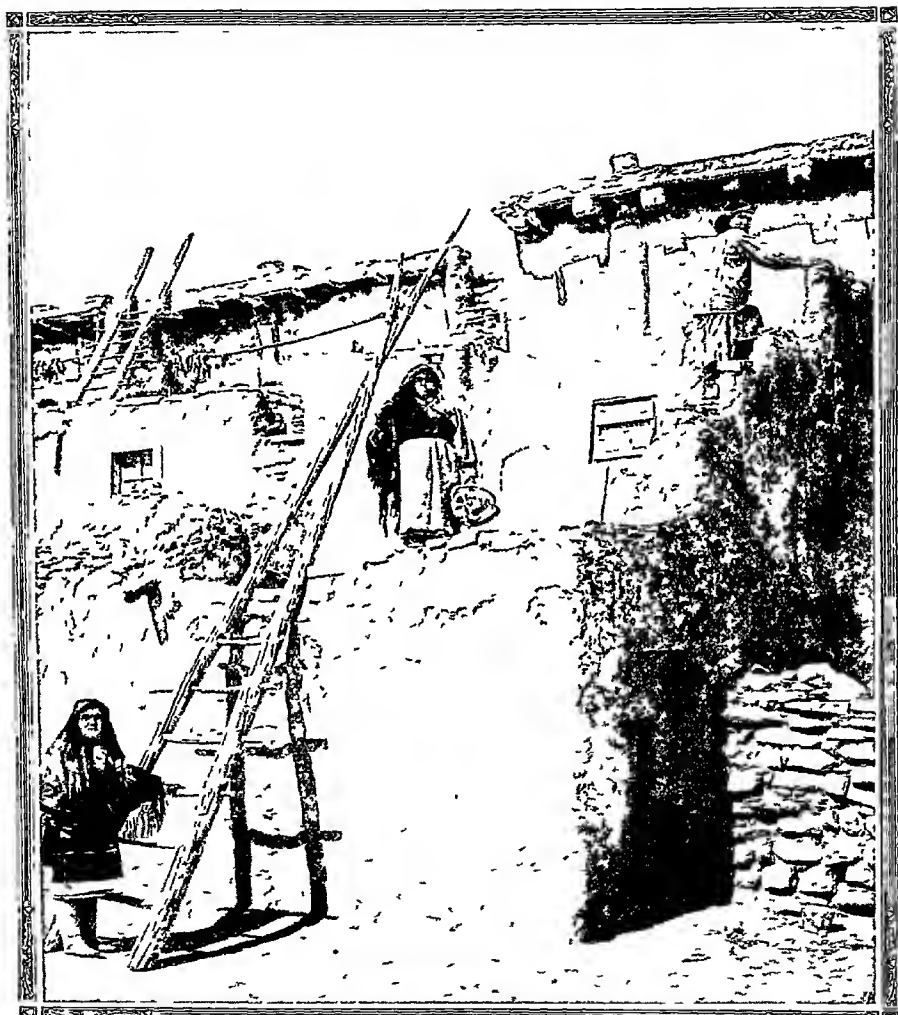
In astronomy his great work was the "Almagest," as Arab scholars called it from

Arabic al-"the," and Greek *magiste*, "greatest." This contained the first treatise on trigonometry, which Ptolemy developed for the use of astronomers. Ptolemy explained all the motions of the heavenly bodies on the theory that they all revolve around the earth, and this theory held sway until Copernicus showed its error.

Ptolemy's "Guide to Geography" was chiefly a set of maps and a list of places with calculations of their latitude and longitude. These calculations were based on an underestimate of the size of the earth and so contained serious errors, but his maps were not improved on for more than 12 centuries. He even gives an account of Britain.

Pueblo Indians. (Pron. pweh'-lo). In the arid regions of the south-western United States there still live tribes of semi-civilized agricultural Indians—Hopi, Zuni, Taos, etc.—who in the early days were named "Pueblo."

AT HOME IN A PUEBLO OF NEW MEXICO



The Acomas, or "People of the White Rock" still live in this sun-baked pueblo perched on the lofty mesa of Acoma, to which their pre-historic ancestors moved from the Enchanted Mesa when a great storm destroyed their only trail. They are a settled agricultural people, and their moccasins have worn a deep imprint in the rocky path that leads to their fields and flocks on the plains below. The women spend much of their time carrying water from the spring at the foot of the mesa or from the great reservoir at its summit, manufacturing the beautiful pottery for which they are famous and making metal out of the corn you see drying on that long pole in the upper left-hand terrace. As a rule the only means of reaching the various terraces of such pueblos is by ladders.

Indians by the Spaniards from their habit of dwelling in stone or mud-brick "cities." The name *pueblo*, applied to these cities, comes from the Spanish word meaning "village" or "people." There are 28 pueblos which are still inhabited, in addition to hundreds of ruined structures. Among the most interesting are the now deserted habitations of the former "cliff dwellers," who are supposed to have been the ancestors of the present tribes.

The typical pueblo, developed from the primitive cliff dwelling, is often placed on the top of a lofty flat-topped hill, called a *mesa*. It is a many-roomed structure, of six or seven storeys piled one upon another like a series of terraces, so that the roof of one building is the "front yard" of the one above. Ladders serve as entrances. Slabs of sandstone are used as building material, the chunks filled with adobe or any bandy substance, but most of the modern villages are built of sun-dried bricks.

The present-day Pueblo Indians are industrious farmers and skilful potters, basket makers, and weavers, like their ancestors. Except for nine Hopi villages in Arizona they all live in New Mexico. They are nominally Christian, though they still retain many of the primitive rites and customs. They number about 13,500.

Puerto Rico. In the warm waters of the Caribbean Sea, just east of Haiti, lies the rich tropical island of Puerto (or Porto) Rico ("rich port"), where sugar-cane is king. The island, roughly rectangular in shape, is 3,435 square miles in area. A range of mountains 2,000 to 3,000 feet high crosses the island from east to

west. The wide northern slope is a mass of dark green tobacco fields on the lower hill-sides, deep-red-berried coffee shrubs above, and waving fields of sugar-cane on every flat. On the southern face, which is much narrower and semi-arid, irrigation is necessary to grow crops.

Tobacco is the second crop, and the coffee plantations also constitute an important part of the island's wealth. Fruit growing has greatly increased, coconuts are an important product, and hundreds of acres yield sea-island cotton.

The island has a population of about 1,720,000, about 73 per cent being white.

San Juan, the capital and largest city (population, about 137,000), is on an island off the north coast, connected with the mainland by a bridge. Its harbour is excellent.

Puerto Rico was discovered by Columbus in 1493, and was in Spanish hands until 1898, when it passed to the U.S.A. by the treaty which closed the Spanish-American War. Since 1937 it has been known by its old Spanish name of Puerto Rico instead of Porto Rico.

Pulse. The phenomenon known as pulsation (Latin *pulsus*, "a pushing" or "beating") is due to the distension of the arteries when blood is sent into them by the contraction of the heart. The beating pulse is usually examined at the radial artery at the wrist, the advantage of that position being that the artery is near the surface and easily compressed against the bone. The veins have no perceptible pulse.

The pulse itself is unimportant. By studying the pulse, however, the physician can learn something of the condition of the heart, blood-pressure, and blood-vessels.

The frequency of the pulse (i.e., the frequency of the heart beat) varies with age, from 130 or 140 per minute in infancy to 70 or 75 in adult age. It also varies with sex, adult females having six or eight more beats per minute than males. (See Blood, Heart.)

Puma. Occasionally when faecal dangers in the Rocky Mountains are riding back through the darkness to their lonely cabins, they are startled by a blood-curdling scream, like the cry of a woman in mortal terror. It



PUMA—'THE CHRISTIAN'S FRIEND'

F. H. Bond

In North America the puma is commonly known as the mountain lion or the panther, while in South America it is often called the cougar. Natives call it "the friend of the Christian" on account of its harmlessness to Man, but it is a dangerous foe to horses and cattle. A skilful jumper, the puma can clear nearly 40 feet in a leap.

is the voice of the puma, mountain lion or cougar (*Felis concolor*). Few persons, however, have heard the puma's cry, for it is the quietest of the cat family, and usually hunts silently, slitting like a shadow on the trail of a deer, or springing without a sound upon a strayed calf, colt, or sheep.

Next to the jaguar of South America, the puma is the largest of America's great cats. It is found from ocean to ocean, and from Canada to Patagonia. The early pioneers called it 'panther' or 'painter' and dreaded it as a fierce and treacherous beast. Pumas have now disappeared from a large part of their former range, but are common in some of the Central American jungles.

Though the puma is a killer of sheep and other small domestic animals, it frequently becomes tame in captivity, and is usually afraid of man, like many of the larger beasts. Tales are told of these beasts actually being so affected by man as to be incapable of defending themselves, and there is at least one account of one of these beasts actually defending a man against a jaguar. Puma kittens at birth are covered with spots and stripes, but these soon disappear to make way for the uniform reddish-brown colour of the parents. When fully grown, pumas measure about 40 inches from the nose to the root of the tail, which adds another 25 inches or so to the length. (See also illustration page 2391)

Pumice. When you use a piece of pumice-stone—often called "pumny" stone by children—to get the stickiest dirt off your hands, you are really cleaning them with glass. For this very light, porous stone is rock which, after being blown as a liquid from a volcano, has cooled like glass too quickly for crystals to form. As it solidified the vapour within it swelled up and the whole was blown into the familiar frothy mass. Powdered pumice is used in grinding glass stoppers, in making grease-removing soaps, for polishing wood, ivory, metals, etc.

Great quantities are exported from the Lipari Islands. Other places where it is found are Iceland, Hungary, parts of the U.S.A., and New Zealand. Because it is so light, and floats easily, it is distributed all over the ocean floors and powdered and wind borne, is found in many parts of the globe. A product similar to pumice results when a jet of steam is blown through the melted slag from an iron furnace. (See Volcanoes)

Pump. Each of us has one of the most marvellous pumps known—a heating heart—working away inside us day and night as long as we live. What is a pump? It is a machine for moving fluids ordinarily for lifting liquids. Among the earliest and simplest devices made by men for the purpose was, probably, the well with the bucket raised by a rope over a windlass. The Persian wheel is another primitive

device. It consists of a wheel placed upright with the lower portion of the rim submerged and with buckets so hung all round the rim that each in turn, as the wheel revolves, dips up water and then pours it out on a higher level. It has been improved into the chain-bucket system, in which the buckets are carried on an endless chain over two wheels, one in the water and another on an upper level.

How the Suction-Pump Works

A much later invention is the suction pump, by which water is first pushed up through a tube by air pressure or suction (see Air) and then lifted by the bucket or plunger. From the pump-head down into the water runs an air-tight metal tube. The pump head is provided with a spout and a handle, which by means of a plunger rod works a plunger up and down in the tube. This plunger fits the tube closely, on its upper surface it carries a valve hinged to open upwards. Fixed in the lower end of the tube is another similar valve.

When the handle is raised, pushing the plunger down, the pressure of the confined air opens the plunger valve but holds the lower or inlet valve shut. When the handle is forced down, raising the plunger and increasing the space between the two valves, a partial vacuum is created and the pressure of the rarefied air within no longer balances the pressure of the air outside. The weight of the outer air shuts fast the plunger valve and raises the water in the pump, opening the inlet valve. So by successive strokes the water is raised until it stands above the plunger, and is lifted to pour out at the spout.

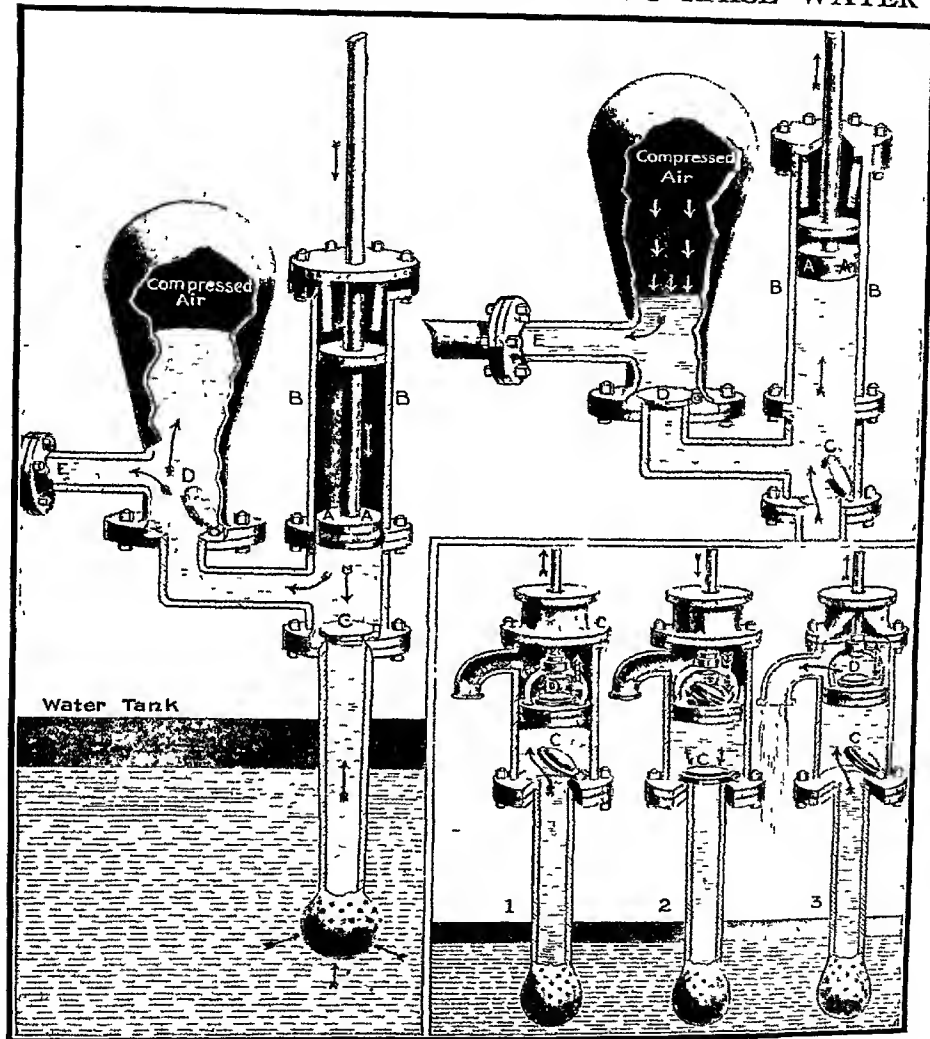
Air Pressure Works the Pump

It is atmospheric pressure alone that raises the water until it passes the plunger valve. For this reason the suction-pump can raise a column of water only to a point at which the weight of the column is equal to the pressure of the atmosphere. This at sea-level, is about 32 feet, and because all pumps leak more or less, the practical limit is about 25 feet.

If water has to be raised to a higher level, some other form of pump must be used. The simplest of these is the force-pump which may be simply a suction-pump provided with a delivery pipe and a third valve instead of a spout. Since the water above the plunger is lifted, not pushed up by the air, it may be lifted to any height by the addition of the third valve to prevent back-flow. An air cushion is commonly added to equalize the flow of water. When the plunger is lifting water, the air is compressed, when the plunger descends, the compressed air expands and presses the water up through the delivery pipe.

There are many kinds of force- and suction-pumps, including air pumps, of which the

HOW FORCE AND SUCTION PUMPS RAISE WATER



The large left-hand drawing shows the downward stroke of the piston (A) in the barrel (B) of a force pump. Intake valve (C) is closed, and water is passing through the outlet valve (D) to the discharge pipe (E), and into the air chamber. In the upper right-hand picture an upward stroke is drawing water through the intake valve (C). The outlet valve (D) is closed and the air compressed in the air chamber by the last "down" stroke is maintaining the flow. In the pictures below the rising piston of a suction pump (1) is drawing water through intake valve (C). On the downward stroke (2) this valve shuts, and the piston valve (D) admits water to the cylinder. The next upward stroke (3) discharges this water and draws up more.

PUMP

bicycle pump is a simple form, impeller pumps, including centrifugal pumps, aspirators, and injectors, impulse pumps or hydraulic rams (see Hydraulic Machinery), and power pumps **Pumpkin**. This plant, with its enormous fruit, is better known in America than in Great Britain, into which country it is supposed to have been introduced from southern Europe towards the close of the 16th century. The first settlers in America found the Indians cultivating this big squash-like fruit in their fields of maize, and ever since those early days the pumpkin has been a favourite article of food in that country.

The pumpkin vine grows to a length of 20 feet or more, and has large leaves, hollow, prickly stems, and large yellow flowers. In America pumpkins are very often planted as the Indians planted them, between the rows of maize. The fruit weighs usually from 10 to 40 lb., but sometimes attains a much greater weight. Pumpkins turn from green to yellow as they ripen, and are ready to harvest only when other vegetation has been killed by the frost. Raw pumpkins are used for cattle food, and the cooked fruit is made into pies.

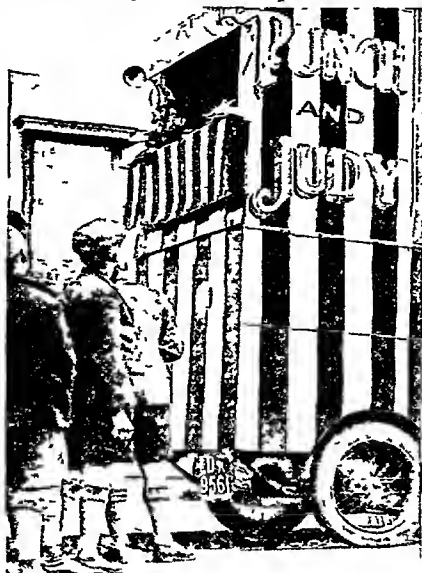
The scientific name of the pumpkin is *Cucurbita pepo*, and it belongs to the same family as the vegetable marrow and the squashes. Pumpkins are frequently called squashes, a term more correctly confined to a rather different species.

Punch and Judy. The Punch and Judy show takes its name from the principal actors in this popular puppet play. Punchinello, to give him his full name, was a hook-nosed, squeaky-voiced, rascally clown of the 17th-century Italian stage. Even today he is endowed with these same peculiar attributes, and, wielding his weighty club, he makes short work of the clown, the clown's wife, his own wife Judy, the judge, the policeman, and Jack Ketch the hangman, as each in turn confronts him.

PUNCTUATION

At various times during his long career Punch has had dukes and even kings and the Queen of Sheba as his stage companions. At one time Punch was made to dance a minuet with a trained pig. In France a cat was substituted in this scene, whereas today, in England, Punch's companion is his dog Toby.

The man who moves the puppets is concealed in a portable cloth covered frame, the upper



PUNCH AND JUDY ON WHEELS

Alas! the hunchback and beaked nose of shrill-voiced Punch are likely soon to be only a memory of the past. How can his primitive actions hope to compete with the varied thrills and high-speed farces of the cinema? Yet while he lingers he still has the power to amuse the younger generation, and for their elders he "conjures up remembrance of things past."

part of which opens to form a small covered stage. As he works them, he utters the dialogue in a peculiar nasal falsetto, varied to suit each character. Numerous modifications are found in the plot, because the dialogue is usually handed down by word of mouth.

Punctuation. A misplaced comma once cost the United States Government nearly a quarter of a million pounds. In a tariff bill about 50 years ago the section enumerating what articles should be admitted free of duty specified "all foreign fruit-plants," etc., but a clerk in copying the bill changed the hyphen in the compound word "fruit plants" to a comma, making it read, "All foreign fruit, plants," etc. The consequence was that for a year, until the blunder could be remedied, all oranges, lemons, bananas, grapes, and other foreign fruits were admitted free of duty.

Manutius, a Venetian printer of the 16th century, is generally regarded as the father of our present system of punctuation. Its principal marks are the following: the full stop or period (.), generally placed at the end of a sentence and at the end of abbreviated words, the comma (,), used to separate words, phrases, and sometimes clauses, the semicolon (;), used to separate clauses or divisions of a sentence requiring a more marked separation than is indicated by the comma, the colon (:), used where an even more marked separation is needed, as well as to introduce a series of particulars or a long quotation, the dash (—), generally used to



indicate a break in the thought or a change in the structure of a sentence, the question-mark or mark of interrogation (?), used to denote a question, the exclamation mark (!), used to express what in grammar are recognized as exclamations, the hyphen (-), used between the divisions of a compound word and to divide any word at the end of a line, the apostrophe ('), used as a sign of the possessive case and to supply the place of any letter or letters omitted from the word, round brackets or parentheses (), used to enclose explanatory matter, square brackets [], used to enclose the words or remarks of an author within the quoted writing of some other person, double inverted commas or quotation

marks (" "), used to enclose any word or words quoted from another person, and sometimes to indicate the title of a book, newspaper, magazine, play, etc., and single inverted commas or quotation marks ('), used to enclose a quotation within a quotation

Punjab. (Pron pun'-jab) The Indian province of the Punjab—"the Land of the Five Rivers" (Jhelum, Beas, Ravi, Chenab, and Sutlej)—lies in the north-western corner of the great northern plain of India, and at one time included what are now the North-West Frontier and Delhi Provinces

The "Five Rivers" have their source in the Himalayas, and combine to form the Indus before leaving the Punjab. The great majority of the Province's 28,500,000 people are engaged in agricultural occupations, the lack of rainfall having necessitated the construction of a vast network of irrigation canals. Wheat, millet, barley, maize, cotton, and pulse are only a few of the crops grown. Rock-salt is exported.

The famous Sikh tribes are largely confined to the Punjab and the native Indian States which are connected with it. These latter take up about 37,000 square miles, while the area of the British

Punjab is 97,000 square miles. The capital city is Lahore (population, 429,000), but Simla (27,000) is the hot weather capital and the summer residence of the Viceroy. Lahore is an historic city, having been of importance under Akbar and his successors of the Mogul dynasty. Other cities are Amritsar (264,000), Multan, and Rawalpindi (both 119,000).

Puppets. These little figures, some times made simply as toys, but more often for use in a special miniature theatre, are as old as dramatic art itself. From England across the Old World to Japan and also in the New World, marionettes, as they are often called, have been used from time immemorial for religious as well as ordinary dramas. In



PULLING WIRES FOR PUPPETS

Puppets, or marionettes, are usually worked by wires or strings from above the stage, as shown in the photo immediately above. The Indians in the upper photograph manipulate their puppets openly.

Photos: top, Arthur's Sister; P. R. G. S. bottom, planet News

many countries there are regular companies of marionette artists, playing from a wide repertory of plays, and it is often in their performances that the oldest folk-plays have been handed down. Thus at Salzburg you may see the original version of "Faust" done at the marionette repertory theatre, and Punch and Judy (*qv*) is itself an example of a traditional puppet play.

The art of handling puppets is a difficult one and one that takes many years to acquire. For this reason a puppet theatre is often a family affair—father, mother, sons and daughters all taking part in the performances. On account of their portability and their universal appeal such theatres travel a good deal, and even in London you may see examples from several nations in a single year. The Italian marionettes have long been famous all over Europe, especially for the variety of their repertoires and the wonderfully complicated effects which they produce. They perform many of the old dramas in which the traditional characters—Harlequin, Columbine, etc.—of the 16th century *Commedia dell'Arte* figure.

The puppets themselves are little dolls, whose legs and arms, hands and feet and heads are movable. These parts, like those of any animals, dragons, etc., which come on to the stage, are attached by fine threads, either directly to the hands of the "players" or to a variety of wooden bars which the players manipulate. The art of working a number of figures, using the fingers and thumbs of both hands at the same time, is obviously a difficult one, especially when there are "lines" to be spoken and even, perhaps, singing to be done. Behind the stage, too, there is a maze of wires and threads, all leading up to the main platform on which stand the operators. The rest of the stage is just like that of a real theatre, except that the wings are open in order to enable the puppets to make their exits and entrances easily.

Purcell, HENRY (c. 1658–1695). Often known as the "Father of English Music" and acknowledged by most critics to be England's greatest composer, Purcell was the son of a Gentleman of the Chapel Royal. At first a chorister himself, he later became organist at Westminster Abbey. The most important of Purcell's early works was a masque incorporated in an adaptation of

"Timon of Athens" (1678), the first of his many compositions for the drama. Appointed organist of the Chapel Royal in 1682 in addition to his Westminster post, he published soon after a book of sonatas, composed the first of his odes for St Cecilia's Day, and also some of his finest anthems, notably the beautiful "They that Go Down to the Sea in Ships." Later he composed one of the most perfect masterpieces of music-drama, "Dido and Aeneas," the first opera in England without spoken dialogue.

Of Purcell's official compositions as "Composer in Ordinary to the King" perhaps the finest are the Te Deum and Jubilate for St Cecilia's Day, produced in 1694, and—written for the funeral of Queen Mary II in the following year—a burial service containing the beautiful anthem, "Thou knowest, Lord, the Secret of our Hearts." Purcell died on November 21, 1695, and was buried in Westminster Abbey. To an era when highly-elaborate madrigals imitated from foreign copies were the fashion, Purcell introduced in his music a beautiful native simplicity.

Puritans. "I will make them conform or I will herry them out of the land." This was the threat that James I made to the Puritans when they asked him to "purify" the State Church of England of certain ceremonies



PURITAN FAMILY AT HOME

The sternly simple atmosphere of the Puritan mode of life and outlook is clearly conveyed by this family group. The picture forms the frontispiece of a book of psalms published in 1563, the object of which was the abolishing of other wayne and tryflinge ballades.

and usages derived from the Roman Catholic Church—e.g., written prayers, religious images and pictures in the churches, and instrumental music in the church services—which they disliked. These Puritans were not dangerous sectaries, but were just plain citizens of England—farmers, merchants, professional men, and scholars especially from the University of Cambridge. They came to be regarded as gloomy fanatics, and it was humorously said that "they objected to hear-hating, not because of the pain to the hear but because of the pleasure to the spectators." The Puritans of the time of James I, however, were not afraid of innocent pleasure. Many of them were fond of music, the Puritan country gentlemen hunted, and the writings of one of the foremost Puritans, John Milton, are a priceless literary heritage.

Some of the Puritans, instead of wanting merely to purify the Church services, wanted to change the whole government of it as well. Others, called Separatists, or Independents,

PURITANS

wanted the Church and State to be entirely separated and each congregation to manage its own affairs, these were later called Congregationalists

It was a band of the Separatists who went first to Holland in 1608, and then to America in 1620, where they founded a colony (See Mayflower, Pilgrim Fathers). Thousands of others went to America, especially during the "Great Migration" of 1629-40. When the Civil War between the King and Parliament gave the control of the government into the hands of the Puritans this emigration for a time stopped.

At the Restoration in 1660 the Puritans lost control in England, but the seeds of civil liberty and of a more serious outlook on life which they planted bore fruit in after years. Greater freedom in government is one of the things which we inherit from these Puritans, along with the works of literary giants like Milton and Bunyan.

Putty. The cement that holds our window-panes in place and keeps air from leaking in around the edges of the glass is called putty. It is used also for filling holes or cracks in woodwork, and is occasionally coloured and moulded into relief ornaments "Jeweller's putty" is used for polishing metals, glass, jewelry, etc. Putty is usually prepared by mixing a form of powdered chalk called "whiting" with linseed oil until a tough dough is formed. When dry it becomes very hard and sticks tightly even to smooth surfaces like glass.

Puzzles. To entertain us, clever people evolve a great variety of ingenious words puzzles, including anagrams, acrostics (qv), and crossword puzzles.

PUZZLES

Anagrams consist of a word, phrase or sentence made up of all the letters forming another word, phrase or sentence. An example is "Flit on, cheering angel," the letters of which, arranged in a different order, make "Florsene Nightingale." An old example in Latin is Pilate's famous question when confronted by Christ: *Quid est veritas?* (What is truth?), which may be turned into an anagram as *Est vir qui adest* (It is the man before you).

One of the most popular of present-day indoor pastimes, the crossword did not really come into favour until after the World War,

although it provided gentle amusement for many Victorian nurses. The modern crossword is often an intellectual exercise demanding literary and general knowledge of unusual scope. Many of the leading newspapers offer prizes for solutions of their puzzles, which vary greatly in difficulty. The principle of the crossword, however, is readily grasped, and will be apparent from the example given in this page. A good dictionary is essential no solution to any clue should be printed until it is known to be correct, so that it can be checked with words crossing it.

The mathematically-minded are fond of springing all sorts of difficult questions on us, such as: Can you arrange the numbers 1 to 9 in three rows, so that the total of each row, added together either horizontally or vertically, as well as the two totals obtained by adding transversely, from corner to corner through the middle, will be 15?

The solution of this "brain-teaser" is:

2	9	4
7	5	3
6	1	8



CLUES ACROSS

- | | | |
|-------------------------|--------------------|---------------------------|
| 1 Try | 25 Her favourite | 45 Stray |
| 5 Sanction | 26 Of punishment | 46 Penalties |
| 10 Part of verb "to be" | 27 Fuel | 47 Deer |
| 11 Hill | 28 Enclosed | 48 Reform |
| 13 Plant's weapon | 30 Domestic animal | 51 Man's favourite number |
| 14 Packages | 31 Racket | 52 Nail |
| 15 Liston | 33 Knock | 54 Gave out |
| 19 Prescription | 35 Journey | 56 Revoked |
| 21 Top | 36 For the seaside | 59 Beverage |
| 22 Bench | 41 Naphin | 60 Spike |
| 24 Denude | 43 Skin | 61 Of one mind |

CLUES DOWN

- | | | |
|-------------------|-------------------------|-------------------------|
| 2 Friends | 18 Feeling | 40 Sleeve |
| 3 Fabric | 20 Copper coin | 41 Article of clothing |
| 4 Contributor | 22 Fuel | 42 Produced |
| 5 The box office | 23 Armed with 13 arrows | 44 Deer |
| 7 Fish | 26 Nobleman | 49 Undiluted |
| 8 Upright | 28 Measure of length | 50 Valley |
| 12 Up to the neck | 34 Utters | 52 Trickle |
| 13 Band | 35 Exhausted | 53 Unusual |
| 15 Half bird | 37 Employed | 55 Shelter |
| 17 Cord | 38 Mallet | 57 Boy's shortened name |

TYPICAL CROSSWORD PUZZLE

A crossword consists of a rectangular space divided into a number of squares; of which every vacant one must eventually contain a letter. Each letter usually forms part of two words, one vertical (down) and one horizontal (across). The words have to be guessed from the clues supplied.



HOW THE PYGMIES LIGHT A FIRE

These Tapiro pygmies of New Guinea make their fires in primitive fashion by rubbing a rope of split rattan in the fork of a cleft stick, the fork being kept apart by a stone. Here a couple are seen blowing the smouldering tinder into flames.

Photo Capt. G. G. Rowling

Jig saw puzzles have a wide appeal, and many people like to cut their own. But the average person is content to solve them often a formidable and lengthy enough task in itself. In this connexion, a good rule is to work inwards from the edges, looking out for the straight edged side and corner pieces. Sort out all the pieces of similar colour, and, if possible, study the grain of the wood at the back.

Pygmies. Homer describes a race of tiny people dwelling in a far southern land where the cranes fly when winter and frost visit the northern shores. This shows that in some manner or other the Greeks had learned of the pygmies who inhabited, and still inhabit, the regions of the Upper Nile and equatorial Africa. The kings of Egypt had pygmies at their courts as early as the 5th dynasty, about 3365 B.C.

The distinguishing feature of the pygmy is his small size, for when he is fully grown he reaches only about 4 feet 6 inches. Some individuals scarcely exceed 3 feet when fully grown.

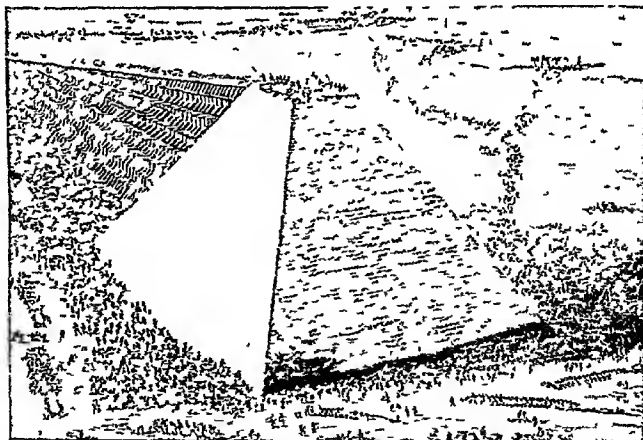
The homes of the pygmies are in equatorial Africa, between Uganda and the west coast of

the continent, and in various parts of Asia. The chief Asiatic pygmies are the Aetas of the Philippine Islands, the natives of the Andaman Islands, the Sakai of the Malay Peninsula, and the Karons of north west New Guinea. Akin to the pygmies are the Bushmen of South Africa, whose average height is only 4 feet 8 inches, and the aborigines of Australia, who rarely exceed 5 feet.

These little people are usually clever and intrepid hunters, and the African pygmies are greatly feared by other natives because of their poisoned arrows.

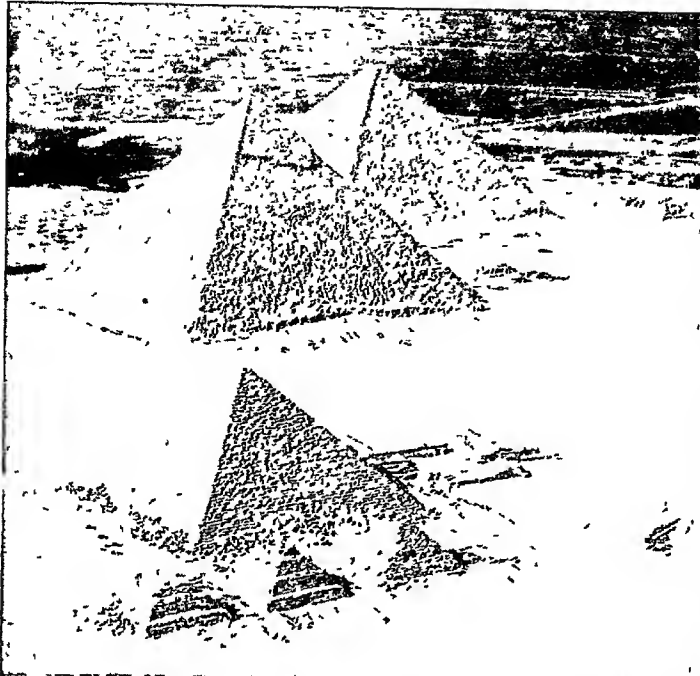
According to one view, the members of the pygmy races are the existing human beings who most closely resemble primitive Man. Others consider the pygmies a degenerate type of the negro race. (See also Dwarfs)

Pyramids. For about 5,000 years the colossal tombs we call the Pyramids have reared their great bulk from the hot sands of Middle Egypt, challenging the wonder and admiration of the generations. Built to protect the bodies of the Pharaohs, they have long since yielded up their secrets. The polished granite and limestone slabs which once encased many of these monuments, concealing the entrance to the tomb chamber and making the sides impossible to scale, have been removed, but the ponderous interior structures, composed of rough-hewn blocks of stone or of brickwork,



THE BUILDING OF THE GREAT PYRAMID

For twenty years the subjects of King Khufu in relays of 100,000 toiled under the taskmaster's lash, building the Great Pyramid as the pharaoh's monument. The Pyramids of Egypt were the oldest of the Seven Wonders of the Ancient World and, alone of them, survive. It is generally believed that the enormous stones were put in position by the aid of inclined planes, such as the artist has shown here.



LOOKING DOWN ON THE ANCIENT PYRAMIDS OF GIZEH

Dutch Air Lines

The pyramids at Gizeh were one of the Seven Wonders of the Ancient World, and here the aeroplane, one of the wonders of the modern world, reveals them, with the help of the camera, in a new and impressive aspect. In the foreground are seen the small pyramids, while beyond them are the Third Pyramid, the Second Pyramid, and the Great Pyramid.

still stand as the greatest of all architectural achievements in point of massiveness.

These royal tombs of ancient Egypt number about 50 or 60 of all sizes. The best examples are the three great pyramids of Gizeh, built by the early kings of the Pyramid Age, probably between 2900 and 2750 B.C. The Great Pyramid, erected by King Khufu (Cheops), was originally 755 feet square at the base, and rose to a height of 481 feet. It is so large that, if it were hollowed out, St. Peter's Church at Rome could stand inside it and would occupy only about half the ground space. There are enough stones in it to build a wall round France. The pyramid of Khafra (Chephren) is but little smaller, while the pyramid of Menkaura (Mycerinus) is only about half as large.

In the Great Pyramid the so-called King's Chamber is well up in the heart of the structure,

connected with the outside by means of two air-channels and an entrance passage, which leads downwards from a point on the face of the pyramid about 47 feet above its foundations, and then branches upwards to the chamber by a concealed passage-way and the Grand Gallery. The original passage-way continues downwards, beyond the junction with the passage to the royal chamber, into the rock below the pyramid, where there is a chamber called the well. A third chamber is found in the heart of the pyramid, about half-way between the bottom and the King's Chamber, connected with it, this is known as the Queen's Chamber.

Besides the three most famous pyramids at Gizeh, there are several other groups, the most important being those at Sakkara. Here is the Step Pyramid, the oldest of all.

Pyrenees. (Pron pi-re-nēz') Extending like a jagged and gigantic wall from the Bay of Biscay to the Mediterranean Sea, the Pyrenees form an almost unbroken mountain barrier between France and Spain. Baie, bleak, and rugged, the peaks reach a mean height of 5,000 to 6,000 feet, with many in the central portion towering to a height of 8,000 to 9,000 feet. Pic de Nethou (Maladetta), one of the highest points in the range, is 11,168 feet high. From the lower tree- and flower-clad slopes branch out deep green valleys, through which wind beautiful streams fed from waterfalls that dash madly down from the rocky heights.

There are practically no game or wild animals, the eastern mountains having been ruthlessly stripped of their former heavy forests, and lax fishing laws have robbed the streams of a once plentiful supply of mountain trout.

PYRENEES

The mineral ores of the Pyrenees are not in general of much importance, though some iron mining is done. Some coal deposits capable of being profitably worked are found on the Spanish side. The inhabitants of the region are chiefly occupied in farming and stock raising, plentiful pasturage for cattle, sheep, and goats being found in the upland meadows.

The tiny state of Andorra with an area of 191 square miles lies in the deep valleys in the heart of the eastern chain. The "Valleys and Sovereignities of Andorra" may be regarded as the last relic of the feudal age in western Europe. In the days of Charlemagne Andorra fell into the power of the latter's agent, the Bishop of Urgel. Today the bishop (a Spanish dignitary) still has certain rights over Andorra which he shares with the French Government.

For many months in the year Andorra is quite isolated from the outside world, and its people are individual in character, language, and customs, though they lean more towards Spain than France. They are governed by a Council General of 24 members.

Pyrometer. If you visit a steel plant and ask questions you will hear a lot about temperatures. If your guide is an engineer he will probably be able to tell you exactly how hot is the glowing stream of metal when they pour it into moulds and even how hot it is in the heart of a roving blast furnace. How can he measure these temperatures? The ordinary thermometer would of course melt and vanish like wax under those conditions. What he actually uses is some form of pyrometer, from the Greek words for fire and measure.

For most purposes, electrical pyrometers are used. There are two types. The thermo-couple or thermo-electric type depends upon the fact that if two wires or rods of different metals are in a circuit, and one of the junction points of the unlike metals is heated, an electric current is set up. A galvanometer, joined in the circuit, measures the current, and the temperature of the hot junction can then be calculated from preliminary measurements at known temperatures. There are many combinations of metals that can be used, but copper, iron, nickel, or platinum is commonly used for one wire, nickel or platinum alloy for the other.

The electrical resistance pyrometer depends upon the fact that the resistance of a pure metal to an electrical current increases regularly when the temperature is raised. Platinum is usually the metal for pyrometers of this type, and the same metal is used for measuring not only high temperatures (over 3,000° F.), but also the very lowest temperatures.

Another type of pyrometer, called the "optical" or "radiation" pyrometer, depends upon the fact that the colour and amount of

PYRRHUS

light and heat radiated by a hot body varies with its hotness. The skilful blacksmith learns to tell from the colour and brightness of the hot iron whether it is of the right temperature for working. In the optical pyrometer, the rough method of the blacksmith is made a scientifically exact method. It is not necessary to put any wire or other body into the furnace, but simply to observe the furnace with this instrument.

"Seger cones" are narrow pyramids about two inches high made of various substances, each of which has a definite melting point. By exposing different cones to the heat in question, and noting the one which just barely melts, a reasonably close estimate of the temperature at that point can be made.

Pyroxylin. (Pron pir oks'-i lin) Nearly everything has to have some kind of coating for protecting or beautifying its surface. Houses, trams, motor-cars, ships, aeroplanes, automobiles, and many other things have to be covered, usually with paint, varnish, or lacquer. A great deal of this kind of coating is made today from nitrated cotton, or pyroxylin.

When cotton, which is mostly cellulose, is treated with nitric acid, two things happen. It becomes soluble in alcohol or other suitable reagents, and if the nitration is carried far enough, it becomes explosive, as it is in gun-cotton. Pyroxylin for paints must not be explosive, so the nitration is carried only far enough to make it soluble. It is then dissolved in liquids that make it thin enough to spread and thick enough to cover, as a good paint must do. Brush or spray paints, varnishes, and lacquers are made by varying the solvent, and by adding pigments, or aluminium or bronze powders to colour the clear colourless solution.

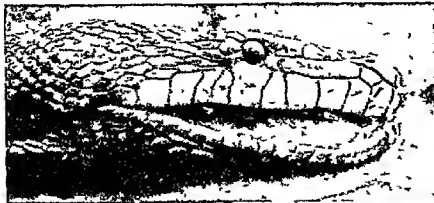
Besides paints, enormous quantities of plastics are made by combining pyroxylin with camphor. Pyroxylin plastics include moving-picture film, substitutes for ivory, and cellophane. Rayon (q.v.), made by the Chardonnet process, is a pyroxylin product. Artificial leather is made on a textile base and coated with pyroxylin; textiles are water-proofed with it, and one type of non-splintering wind screen glass contains a sheet of the material, bound with adhesive solution between two sheets of glass.

Pyrrhus. (Pron pir'-us) KING OF EPIRUS (About 318-272 B.C.) Among the many rulers of petty kingdoms who sought to gain power after the death of Alexander the Great, one of the most celebrated was Pyrrhus, king of the mountainous little country of Epirus, to the north-west of ancient Greece. A brilliant and dashing soldier, he was ambitious for glory and determined to found an empire in the West.

A quarrel had broken out between Rome and the Greek city of Tarentum in Lower Italy.

PYRRHUS

When the Tarentines applied for assistance, he gladly responded and crossed the Adriatic with about 25,000 troops and a number of war elephants. The forces met at Heraclea, near the Tarentine coast, and there a fierce battle was fought (280 B.C.). Pyrrhus won the day, but his loss was so great that he is said to have exclaimed after the battle, "Another such



victory and we are lost!" Thus arose the expression "Pyrrhic victory," which we still use of a victory so costly that it is little better than defeat. After another such victory at Asculum, he withdrew to Sicily.

Here, in aiding the Syracusans against the Carthaginians, he saw another opportunity for conquest. At first he met with brilliant success, but he soon lost popularity. He returned to Tarentum, and met final defeat at the hands of the Romans in the battle of Beneventum (274 B.C.). Returning to Greece, Pyrrhus engaged in various military enterprises, but failed to realize his ambitions. He was almost on the point of gaining the Macedonian crown which he so much desired, when, having been called to Argos to help in settling a political quarrel, he was killed by a tile thrown from a roof.

Pythagoras. (Pron pi-thag'-o-ras) (About 582-500 B.C.) One day, seeing a dog beaten and hearing him howl, the Greek philosopher Pythagoras bade the striker cease, saying, "It is the soul of a friend of mine, whom I recognized by his voice."

PYTHON

This remark illustrates the belief of Pythagoras that at death the soul passes into another living creature. Belief in the "transmigration of souls" is common among primitive peoples and is still accepted by the followers of Brahminism.

Pythagoras is said to have spent 30 years visiting various countries about the Mediterranean Sea. About 529 B.C. he settled in Crotona, a Greek city of southern Italy, and founded a religious brotherhood, bound by vows of sobriety and self-control and to the observance of certain mystic rites.

The Pythagoreans, as the followers of Pythagoras were called, made many important contributions to the sciences of mathematics and astronomy. They discovered the general proof of the important fact that "the square on the hypotenuse of a right-angled triangle equals the sum of the squares on the other two sides" (see Geometry).

They were the first to teach that the earth is a globe, revolving with other planets round a central sun. They also found that the length of a musical string is in exact relation to the pitch of its note. Numbers fascinated the Pythagoreans to such an extent that they claimed that "all things are numbers," or that numbers were the substance of life.

Python. The tropical parts of Africa, Asia and Australia are the haunts of these snakes, which belong to the family Boidae. The reticulated python (*P. reticulatus*) of Eastern Asia reaches a length of as much as 30 feet, and is the largest snake found in the Old World. Other well-known species are the Indian python (*P. molurus*),

the African rock python (*P. sebae*) and, in Australia, the beautiful carpet snake (*P. eplotes*).

Pythons are equally at home sliding through dense underbrush, climbing trees, or swimming. They kill then prey by coiling their muscular bodies about the victim and crushing it.

The female python lays about a hundred eggs, which she collects in a heap, then wraps herself about them until they hatch.



BIG SNAKES THAT CLIMB TREES

Certain snakes have become quite expert at climbing trees. Like the royal python seen above, they work from branch to branch by taking a turn with their tails round the bole and so pushing themselves upwards. The upper illustration shows the head of a reticulated python.

Top photo F. H. Bond

